RADIO, TELEVISION and HOBBIES

Volume 23, Number 6 **September, 1961**

THIS "CITIZENS' BAND"

SINCE the publication of our last issue, carrying an article on the U.S. Citizens' Radio Service, we have had consistently favourable reaction from individual readers and from trade representatives alike. Not a single person has voiced opposition to the suggestion that some similar scheme should operate in Australia.

Plenty, however, have criticised local "red tape" and made dark suggestions as to why Australian citizens have been denied as free use of radio channels as they would like. Mostly, these centre around the fact that the Postmaster-General's Department, which is the radio licensing authority, also derives revenue from the nation's telephone system.

I wonder? To be sure, the department has appeared not to encourage thinking along the lines of a Citizens' Band. But, equally, the radio industry has appeared not to care less!

Quite a few manufacturers have observed the "C.B. boom" in the U.S. Some even have equipments to hand which are readily convertible to this kind of service. They say they would like to see such a service set up, but not one person to whom I talked had taken the trouble to communicate their views to the appropriate authorities. Rather have they dismissed the proposition with the remark—and I quote one highly placed executive—"we just don't have a Citizens' Band in Australia."

In fact, we never will have one unless individuals who want the equipment and firms who want to sell it make their voice heard in official quarters. Only after representations have been made and rejected can the authorities fairly be criticised.

Personally, I feel that suppositions based on competition with the telephone service are trivial. No one in their right senses would pay a couple of hundred pounds to talk to an individual who could be reached more reliably by telephone for fourpence. The whole basis of Citizens' Band operation is that the individuals involved cannot easily communicate by other means.

In publishing what we have about the Citizens' Radio Service, our purpose has not been to embarrass or to buy a fight with anyone. Rather has it been to set a lead which we hope others will follow. If the matter is important to you personally, or to the firm you represent, this is the time to make representation in the right quarters.

W. N. Williams

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Cover Picture:

Typical of the penetration of electronics into heavy industry is the computer-controlled flame profiling machine installed at British Oxygen Engineering Ltd. Electronically controlled from the booth seen in the foreground, the flame profile machine is commonly used to cut complex patterns in steel plate required for shipbuilding purposes. Note the tape on the left on which is stored the information used to guide the cutter. (Original picture from the Central Office of Information, London).

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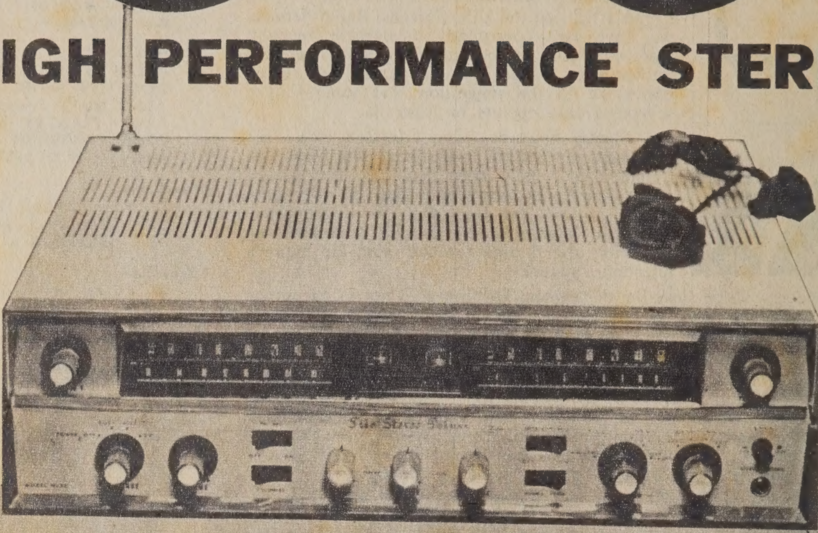

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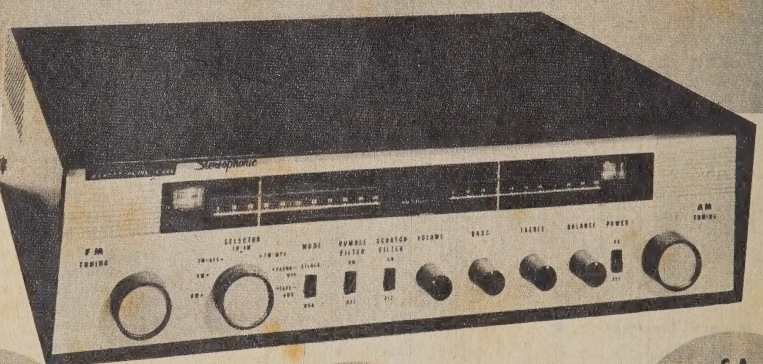

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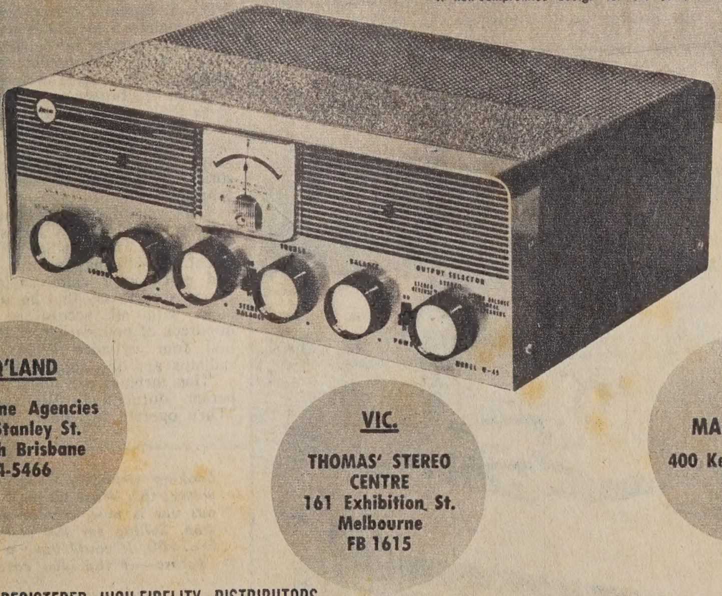
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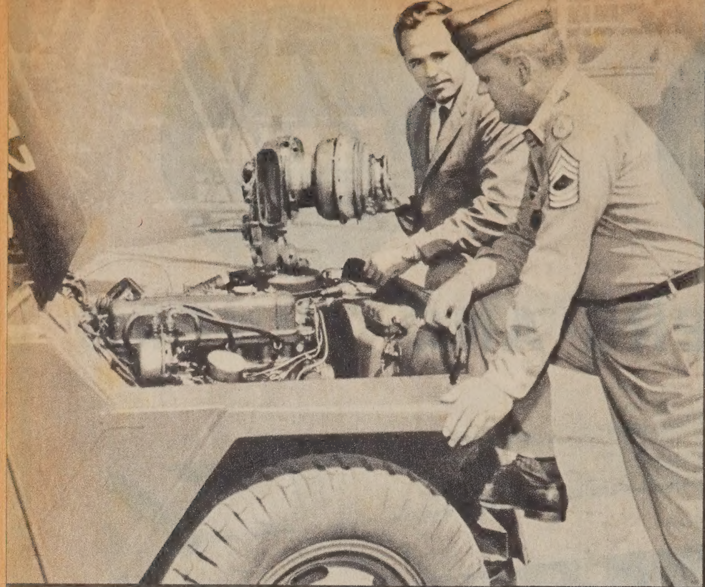


Significant progress is being made with small turbines for use in passenger cars. This revolutionary lightweight unit is about to be installed in a U.S. Army jeep. Weighing only 50 pounds, it occupies far less space than the reciprocating engine which it is to replace.

Old Ideas Get The Modern Treatment

Because so much money is invested in the automobile and allied industries and because competition is so fierce, manufacturers are forced to keep pace with each other in all aspects of futuristic developments, no matter how expensive.

MANY firms are currently exper menting with basic power uni and propulsion systems which may n go into production for 30 years—if the Into this category come fuel cells, nu lear-steam reactors, solid fuel engin (developed mainly for possible inte planetary transport vehicles) and reger erative electrical systems.

The turbine engine is one exceptio Motorists are growing tired of hearin that it is "just round the corner" but th truth is that the turbine is now an eve more outstanding prospect for the nea future.

More teething troubles and develop ment headaches have occurred than wer first expected, but at last practical, lon lasting, efficient turbines are ready fo production cars.

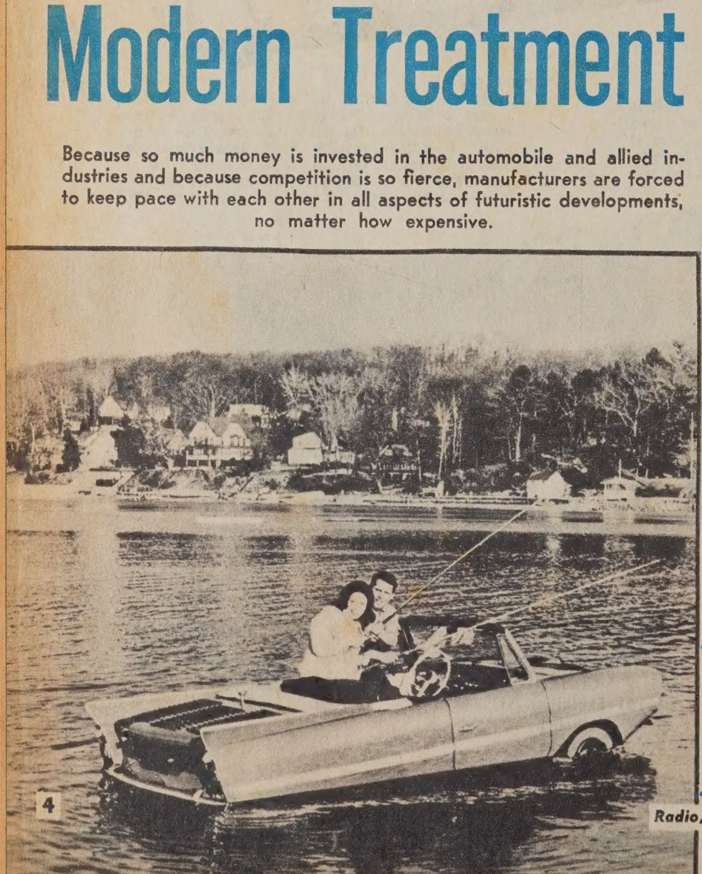
Whether or not car designers are read for turbines, is another matter. Mos manufacturers say no. They point ou that their automated factories are toole up for reciprocating units and ther would be little advantage in making switch. The unknown public reaction t the turbine, with its high-pitched whine tremendous speeds and lack of low speed torque, is another influencing factor.

But this reporter would like to make it clear that turbine design has now reached the stage where no manufacturer can ignore it. It could take only one move on the part of a major firm to precipitate a trend that would result in everyone having to offer at least one turbine model.

Neither size nor lack of efficiency hampers the turbine. Some months ago, Williams Research Corporation of Michigan installed a revolutionary lightweight turbine in a Jeep, on behalf of the Ordnance Tank Automotive Command in Detroit. The engine weighs only 50lb, develops 75 horsepower and is claimed to be the smallest gas turbine ever tested in an automobile. The basic engine is 10 inches in diameter, and 19 inches long. To this must be added the accessories, intake and exhaust system and gearbox.

"This version of the engine is intended for use in such light vehicles as the Jeep and sports cars," says Sam Williams, president of Williams Research Corporation and ex-Chrysler chief engine engineer. He goes on to say that his turbine, complete with all accessories, is several hundreds of pounds lighter than the normal four cylinder Willys engine, its radiator and the cooling system.

"Gas turbines are noted for their inherent durability," Williams declares. "They operate for much longer periods



Looking strangely at home in the water, this West German amphibious car is now in volume production. Selling for the equivalent of £A.1500, it could have a very big future—if the idea catches on.

vithout requiring servicing; they have the bility to burn a wide range of fuels, ncluding diesel, and deliver high torque .t low vehicle speeds without unduly omplex transmissions."

On the subject of turbines, the Rover ompany, originator of the automotive mit (publicly demonstrated in May, 950) have developed a unique turbo-rop engine for light aircraft. Based n their highly successful car design, the ew engine has the potential to replace iston units on a wide range of private, lub and business aircraft.

Suitable for existing machines (without irframe modifications) or entirely new lesigns, the turbo-prop unit is available n both 60 and 90 horsepower versions.

The main advantages are vibration-free peration, low maintenance requirements, accessibility of units and long life. They run on either kerosene or diesel and are said to be economical in operation.

Considerable expensive research is also being done on a range of Ground Effect Machines. Originally, there was some talk of these so-called air-cars being challengers to the automotive industry, but inherent disadvantages now make it clear that they are best suited to some unique transport situations (on plantations for example) and for monorail carriage construction.

Long before wheelless cars are built in quantity, the public are likely to see new systems of transport, capable of challenging the aircraft industry.

By Pedr Davis

Ford, Renault and several other major car firms are now actively engaged in building experimental mono-car systems, in which hundreds of people can be carried at speeds approaching 50 m.p.h. for indefinite distances. At present Renault use overhead wheels, but Ford use Leva-pad air cushions.

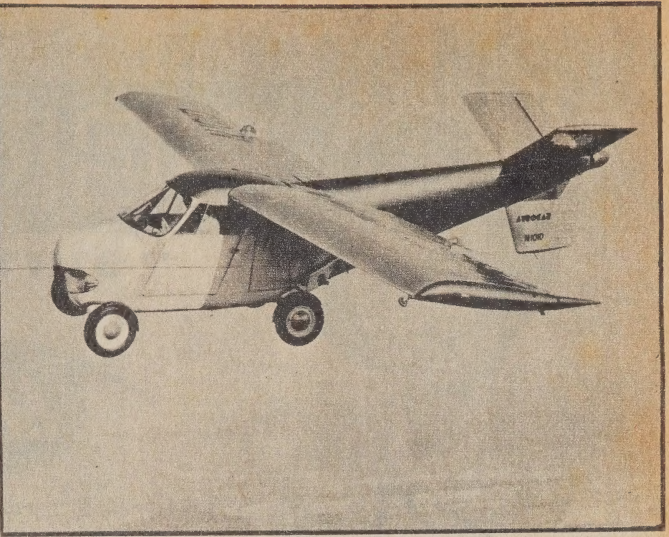
Apart from reduced operating costs, compared to either aircraft or diesel electric rail engines, the new systems will be capable of carrying passengers from the heart of one city to the middle of the next in a time not currently possible with any known transport system.

The Ford mono-rail carriage depends on the use of "Leva-pads" in which a film of air forms an almost frictionless bearing between the rail and carriage support. Forward propulsion can be effected by a variety of means, including turbo-prop and jet engines.

Visions of air-cars competing with conventional wheeled vehicles have largely evaporated during the past 12 months. Even the most advanced GEMs (as ground effect machines are now called) can be hopelessly outclassed.

The conventional vehicle is far more manoeuvrable, uses roughly one-quarter the same amount of fuel, will go at twice the speed and carry four times as much weight, as a GEM of comparable size and power.

The main advantage of the GEM — its ability to travel over water, swamp and sand — is largely offset by the fact that it baulks at anything suggesting a hill. Currently, the most advanced GEMs can tackle grades up to 8 per cent, but thereafter they sink ignominiously to the ground. Even the most optimistic of designers does not expect to improve materially on this position.



Flying cars have been in and out of the news for so many years that it is difficult to take them seriously. However, an American firm is currently setting up a dealer organisation to market this unit for the equivalent of £A.5,000. They hope to attract a "businessman" market.

Yet another way of getting across water is to go by Amphicar. This is a brilliant new vehicle currently being built in large quantities in West Germany and marketed mainly in America.

The Amphicar is a successful conclusion to a time-honoured dream. It is a touring car that is equipped to tackle water with nothing more than the movement of one lever.

Such amphibious vehicles have been produced before, of course, but none have been as simple, compact and cheap as this one.

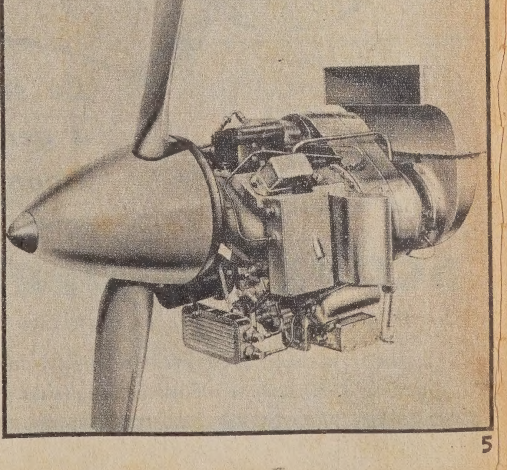
It is not quite as long as a Morris Minor and weighs 20 cwt; the engine is a four cylinder water-cooled job, located at the rear, driving the normal road wheels and the twin propellers as required. Both propeller and wheels can be driven at the same time (where required) to get in and out of water.

The Amphicar is at present selling for the equivalent of £1,600 in America but, as far as we know, no plans have yet been made to come to Australia.

Running costs are said to be 35 m.p.g. when used as a road vehicle and 1½ gallons per hour when cruising on the water at about 10 m.p.h. Four passengers and their luggage can be carried, giving a freeboard height of 21½ inches. The boat will go backward and forward for manoeuvring, and is claimed to be extremely safe and stable.

Yet another way of combining motoring with another pursuit is to own a flying car. Once again, the idea is nothing new, but big strides have been made

(Continued on Page 109)



The engine from the much publicised Rover turbine car was subsequently redesigned for industrial applications. Now it has developed into a highly compact 90hp. unit capable of replacing existing light plane power plants or of powering new designs.

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'Minuteman' Missile Rides The Rails

The U.S. Army Air Force "Minuteman" intercontinental ballistic missile (ICBM) being launched for the first time at Cape Canaveral. It was described as a "complete success," with all three sections igniting as planned and the re-entry vehicle landing in the target area, under the guidance of its own inertial guidance system.

By Thomas Riedinger

Red flame spurted from the base. Accompanying smoke engulfed almost half the missile before it leapt into the air. Within a second from ignition, the missile was almost clear of the tower. Two seconds later the missile nosed over to the south-east, wobbled slightly before its four nozzles steadied the flight, then arched gracefully through the sky.

IF nothing else had worked beyond this point, the U.S. Army Air Force Minuteman intercontinental ballistic missile's first flight would have been considered a success. All primary test objectives had been met.

Minuteman, however, continued on to its target and made the most successful debut in the history of United States missilry.

Behind the reddish flame was a trail of white smoke which combined with the vapour trail as the missile sped through the tropopause.

The spent first-stage engine was cast off after one minute of flight; the second stage after two. At the three-minute mark the re-entry vehicle freed itself from the final booster and continued along a pre-determined arc to a target area several thousand miles down the Atlantic Missile Range.

As in the case of any event of great importance, that flight of February 1, 1961, had considerable effect on many people.

General Thomas D. White, Chief of Staff, USAF, said the flight was one of the most significant steps this nation had ever taken towards gaining intercontinental missile supremacy in the years just ahead.

"The launch was the most recent in the series of successes which have marked the Minuteman program since its inception, and which will lead to having the Minuteman operational at least a year earlier than was at first thought possible."

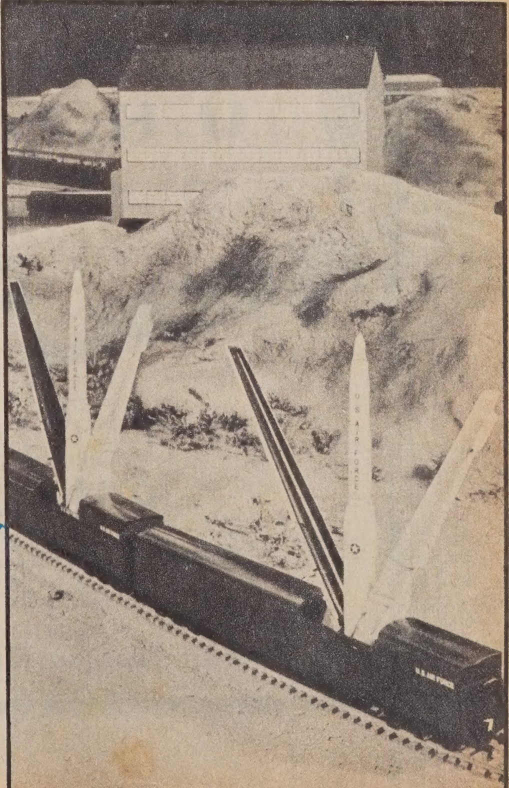
Minuteman is now scheduled to become operational in 1962. The solid-propellant ICBMs will be stored ready for launch in blast-resistant underground silos and aboard special railroad trains travelling at random around the nation's vast rail network.

So it was that a new passenger was introduced formally to the railroads of America a few weeks ago — Minuteman. The Air Force purchased a "tourist-class" ticket for the economical new weapon system and placed the intercontinental ballistic missile in a baggage car.

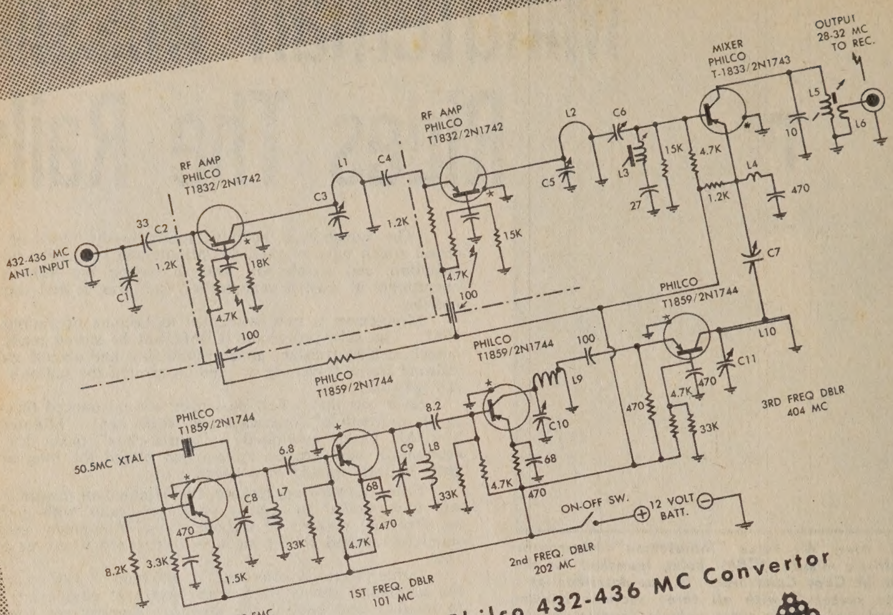
From outward appearance, the Minuteman missile trains will look similar to regular passenger trains with perhaps an abnormal number of baggage cars. Equipment used in standard railroad rolling stock is being used wherever practical.

Inside, there is considerable difference. For example, the command car is lined with electronic equipment used to monitor and control the missile. Another car contains four diesel generator sets and two large fuel tanks. Because of power requirements the missile section of each train must be capable of generating its own electricity.

The basic difference is in the missile car. Three feet longer than standard baggage cars, they will be among the heaviest units ever to travel on rails. Each missile will be carried inside a protective strongback resembling a long clam-



Portion of the model which was shown recently to U.S. railroad chiefs. Operated from the control car, the missile is elevated inside twin supporting shells, which release their grip on the missile a split second before it ignites. "Minutemen" uses the largest solid-propellant first stage developed to date. All three stages have a higher specific impulse than any engines of their size and weight in existance.
(Pictures by courtesy of the Boeing Airplane Company, Seattle, Washington.)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shell hinged at one end, which will raise the missile and open only a split second before the missile is launched.

A typical trip, technically known as a deployment cycle, will last about two weeks. During this period, the Air Force crew attending the missiles will be mustered and quartered within the train in much the same manner as a flight crew at a Strategic Air Command base. For this reason, personnel problems are receiving careful attention.

A full-scale mockup of a missile train was reviewed recently at the Boeing Developmental Centre at Seattle. The train was part of an exhibit that would delight the heart of a model railroader. The show, however, had a deeply serious purpose.

SPECIAL PROBLEMS

A select team of Air Force technical experts studied every aspect of the program which, for the first time, utilises public transportation routes for an operational weapon system. After listening to briefings and studying exhibits covering every phase of the program, the experts requested only a few minor alterations. The lack of change requests served as an excellent tribute to Air Force and industry people responsible for developing the mobile concept.

A few days following the Air Force review, executives of the nation's railroads toured the exhibit and were briefed on plans for operating the country's newest deterrent force. Although many of them had assisted in the "Big Star" train tests last summer, this was their formal introduction to their new passenger.

The simplicity of mounting missiles aboard trains travelling at random within the United States has led many observers to look for the mousetrap in such a plan. Scepticism was somewhat evident when members of the nation's Press corps were allowed to tour a declassified version of the exhibit after the railroad executives received their briefing. Safety, security and sabotage prompted many of the questions raised.

LITTLE DANGER

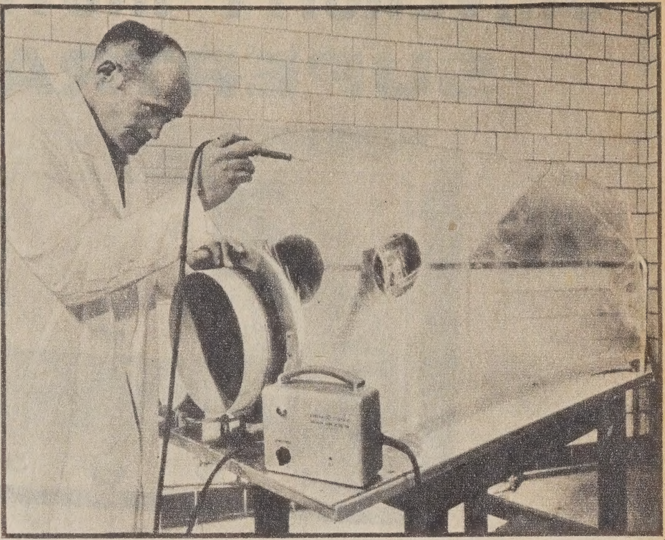
Lieut.-General Bernard Schriever, Commander of the Air Research and Development Command, held a conference to discuss such problems. He explained that there would be less danger, insofar as the general public was concerned, from a missile train than from trucks and trains currently carrying inflammable liquids. With regard to security, he pointed out that the random movement of the trains did not permit spies an opportunity to relay alert locations to a potential aggressor in time for the trains to be targeted.

Sabotage would be extremely difficult. To be effective, saboteurs would have to destroy all of the trains simultaneously. Because of the vast number of launching sites, track wrecking would serve only as a notice of coming hostilities. The situation was best summed up by one reporter who remarked, "If anyone has enough well-trained agents within our nation to destroy all of these trains, we'd better start worrying about what else they could do."

After intensive study of possible problems related to mobile Minuteman, the railroad men came up smiling.

P. A. Hollar, vice president for research for the American Association of Railroads, summed up their reaction to the job ahead: "No trouble at all."

DETECTS MINUTE GAS LEAKS



The halogen leak detector, an instrument designed primarily for air conditioning and refrigeration servicemen, has found an interesting new application in the world of science. In the United States, at Notre Dame University's Lobund Institute, where transparent vinyl isolators are used in medical research with animals, portable electronic leak detectors made by General Electric Company (U.S.A.) are being employed to ensure the sterility of the experimental chambers.

BECAUSE the vinyl is thin and susceptible to breaks, the research could not be effectively carried out until Lobund, after trying other methods of leak detection, selected the General Electric instrument as the best suited for their purposes in terms of economy, convenience and required sensitivity.

To check an isolator, a research assistant fills it with Freon gas and moves the probe of the leak detector over the entire surface. Microscopic holes in the vinyl, indicated by a flashing light in the probe, are marked immediately for patching.

STANDARD UNIT

The type H-6 leak detector in use at Lobund Institute is the same one utilised in servicing air-conditioning and refrigeration equipment. Consisting of a control unit and a 15-foot probe, it can be used to locate leaks as small as half an ounce a year. According to its designers, it is safer, more sensitive and quicker in response than the common halide torch, and its sensitivity is not affected by brilliant light or air circulation.

They add that because it automatically adjusts itself for an atmosphere contaminated with halogen gas, responding only when a leak is encountered, it is especially useful where halogens, in the form of such compounds as refrigerants, paints and varnishes, may already be present in the air—for example, during the installation of large commercial or shipboard air-conditioning systems or in confined unventilated devices like vending machines.

LEAK STANDARD

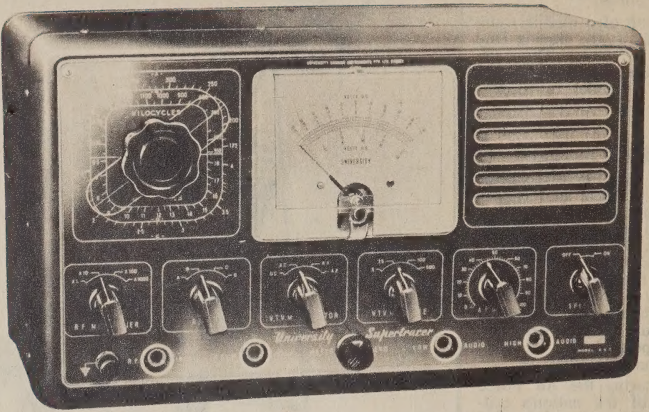
The H-6 leak detector forms part of a serviceman's kit offered by General Electric that includes, in addition to the detector, a new "leak standard." This instrument, which is needed to calibrate and check the sensitivity of the detector, makes it possible to measure, in ounces per year, the size of a leak.

The kit, which is enclosed in a compact, portable leather case, also contains sufficient spare parts for about a year of normal maintenance and an instruction book describing use and repair of the equipment. It is available through the International General Electric Company, a division of General Electric.

(Editor's note: "Halogen" is the term applied to a group consisting of the non-metallic elements, fluorine, chlorine, bromine and iodine).

UNIVERSITY INSTRUMENTS

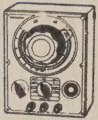
SUPERTRACER



MODEL AST

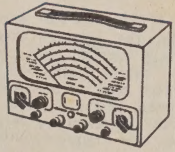
Here is the best labour-saver and profit-maker a radio workshop can have. It is a modern and highly efficient signal tracer and fault finding is speedy and easy with the new instrument. Convenient to use, it will give new speed to the detection of faults in radio receivers and similar equipment. One of the worst features in a faulty radio receiver is intermittent operation. Now you can easily find it with this new supertracer. Lack of sensitivity, radio frequency oscillation, audio oscillation, distortion, hum and a host of other faults can quickly be pinned down with the model AST. The instrument, measuring 14½ in. long by 9¾ in. high and 8¼ in. deep, has a black and silver anodised front panel. Here is an instrument you cannot afford to be without.

OTHER INSTRUMENTS IN THE COMPREHENSIVE "UNIVERSITY" RANGE



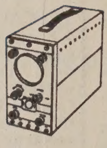
RESISTANCE CAPACITY TESTER—MODEL UBA

This instrument is designed for the measurement of an extensive range of resistances from 0.1 ohm to 10 megohms and capacities from 10 μμF to 10 μF. The UBA is sensitive and OVERLOAD PROOF.



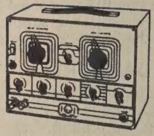
ELECTRONIC VOLTOHMETER —TVR/EV

This smartly styled, large-scale Electronic Voltmeter, although designed especially for servicing television receivers, will also test and align A.M. or F.M. receivers, measuring AVC grid bias and screen grid voltage in high-impedance circuits.



OSCILLOSCOPE— MODEL—TVR/C3

This small portable Cathode Ray Oscilloscope will be found invaluable for TV and radio service work and is extremely handy for all tests. Industrial users, too, will find many profitable uses for this lightweight instrument.



TELEVISION ALIGNMENT GENERATOR—TVR/SM

This University instrument is the ideal signal source for precision alignment of TV and F.M. receivers. Model S.M. combines both a precision marker generator and sweep oscillator in one convenient metal case.

UNIVERSITY GRAHAM
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TV Servicemen and Service Organisations are invited to inspect the Television and Radio Test Equipment under working conditions in University's special demonstration room.

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TELEPHONE BU 3169

NEW WALL LIGHTS, HEATS, COOLS

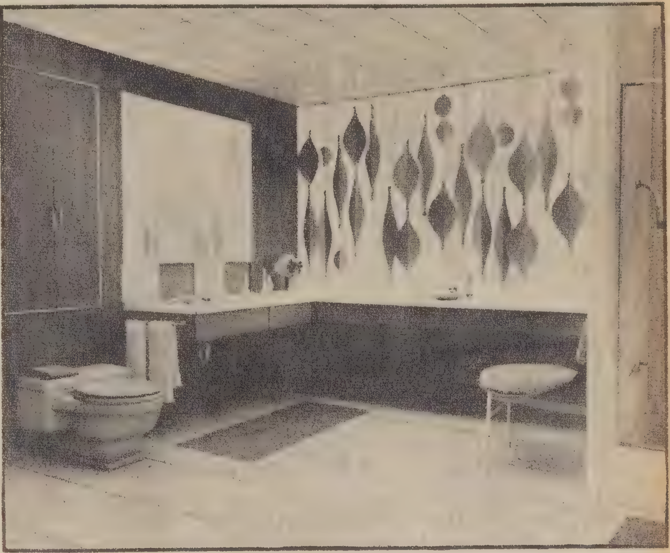
A full-scale wall panel that promises to light tomorrow's home while also heating or cooling it was unveiled by Westinghouse Electric Corporation

THE "hot-cold-light" panel responds to a set of dials which can change its temperature from a low of 55 to a high of 120 degrees Fahrenheit and vary the intensity and colour range of the light source.

The versatility of this "hot-cold-light" panel results from combining into a single operating unit two of man's latest technological advances: thermo-electric heating and cooling, and electroluminescent lighting, according to Chris J. Witting, Westinghouse vice-president and general manager, consumer products. "The panel," he said, "opens up entirely new concepts for modern living."

"Where we now have separate components for lighting, heating, and cooling the home," Mr Witting said, "the panel integrates them into a single unit which is at once functional and decorative. The possibilities for interior design are tremendous.

"A living-room could be illuminated with a white or golden light during the day, for example, and then by converting to soft blue tones the same room could be transformed into a totally different mood for evening time.



In the bathroom of tomorrow, you will be able to shower and shave with the room temperature just to your liking, and with lighting to match your mood. Thermoelectric panels and electroluminescent lighting combine to produce this new luxury.

FESTIVE OCCASIONS

"For festive occasions the colour and intensity could be bright and cheerful. For a restful effect, tones could be soft and subdued. Entire sections of the ceiling could be covered with electroluminescent panels in full or in pattern.

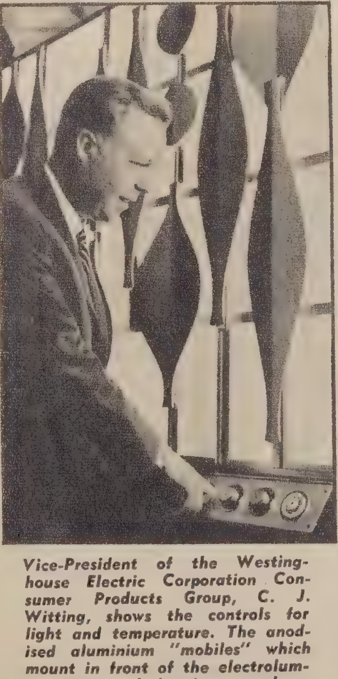
"This achievement, however, is still very much in the developmental stage, and Westinghouse has no plans at this time for introducing such a panel as a comercial product."

To demonstrate how the hot-cold-light panel could be used to advantage in tomorrow's home, colour photographs of model settings were arrayed recently, beside the working prototype in a preview showing. These pictures depicted dining-room and bathroom settings designed by Peter Muller-Munk and Associate of Pittsburgh, Pa.

The actual light screen of the demonstration panel provides a range of hues from blue to blue-green to green. Other colour combinations including the entire spectrum are possible, according to engineers at the Westinghouse lamp division in Bloomfield, N.J.

Part of the thermoelectric assembly is superimposed in artistic designs or "mobiles" of anodised aluminum in front of the electroluminescent screen of the panel. These mobiles serve to heat or cool the air of a room. The remainder of the thermoelectric assembly is hidden from view behind the glowing screen.

Controls for the entire panel consist of four dials; one to change colour combinations; a second to vary the light intensity; a third to select either heating or cooling; and finally a thermostat for automatic temperature control.



Vice-President of the Westinghouse Electric Corporation Consumer Products Group, C. J. Witting, shows the controls for light and temperature. The anodised aluminium "mobiles" which mount in front of the electroluminescent panel, forming a modernistic pattern, provide the surfaces for heating or cooling the room.

In dimensions, the panel is six feet long and four feet high. It glows with a diffused light which is complimentary to the appearance of a room.

The thermoelectric effect is accomplished without the aid of any moving parts such as are present in the conventional refrigerator. Thermoelectric refrigeration produces cooling in special solid materials directly from the flow of an electric current. Heating occurs when the directon of current is reversed.

Electroluminescent lighting is produced by exciting a phosphor coating with an alternating current. This phosphor coating is sandwiched in a panel no thicker than a pane of window glass.

PRINCIPLE IN USE

The principle of electroluminescence is used in Rayescent lamps now being produced by Westinghouse and available for applications other than general lighting. In addition, Westinghouse has just begun to market the first electroluminescent light for use by the public — a Rayescent Safety Light or night light that will consume less than a penny of electricity even though operated 24 hours a day for an entire year.

Mr Witting commented that the "development of the hot-cold-light panel has been an unusually rapid process."

"Only in recent years has the thermoelectric effect been under an intensified investigation in laboratories throughout the world. Last July Westinghouse demonstrated a hostess cart with both cooling and heating compartments. At the same time we exhibited another thermoelectric device that cools or warms a baby's bottle at the flick of a switch.

Man has gained his greatest mobility under water with modern aqualung equipment but there are still plenty of traps for the unwary in skin diving.

Diving Isn't Easy For Mere Humans

When the latest U.S. space capsule sank in three miles of water, it underlined the fact that man, able to orbit the earth beyond its atmosphere, still has the greatest difficulty in penetrating the depths of the ocean. In fact, to retain any degree of freedom, his limit is a few hundred feet!

By Calvin Walters

THE exploits of divers who dare the ocean depths to recover sunken treasure have always held a strong fascination for young and old alike.

Many indeed are the stories of sunken Spanish treasure, locked up in galleons resting on the bottom of the ocean.

Why they always seem to be Spanish galleons I wouldn't know. One would think that only the Spaniards of old were the wealthy ones, the pirates and all that. But piracy was not peculiar to any race of people in those days—and much the same position exists now.

There are still pirates, afloat, on land and in the air, but their methods are more refined and more subtle.

Whereas, in the olden days, pirates went to work with cutlasses and cannonballs, the present-day pirate operates by the sale of tickets and shares, or the transfer of title deeds. This is not to say that all people who operate in this way are pirates, but many who do are, if you know what I mean!

The ability to remain under water for a period of time has been cultivated for centuries by natives of various countries and the art has been mainly applied to the recovery of pearl shell and other aquatic products, such as sponges.

The most primitive natives merely filled their lungs with air, dived head first into the sea from a canoe, quickly swam to the bottom, grabbed the catch and as quickly returned to the surface.

Because of the energy expended in swimming to the bottom, carbon dioxide was quickly generated in the lungs, with the result that the sojourn at the bottom was brief before they found it necessary to rise and take a new breath.

More advanced divers used a lead weight held in the hand. Standing at the bow of the boat, with the lead weight uplifted above the head, they dived into the sea. A rope tied aroun the diver's waist was held by an offside in the boat.

The lead weight quickly took the dive to the bottom, where, after collectin his salvage, he gave signals by pullin on the rope, whereupon his mate woul lift him to the surface.

By the use of the lead weight th diver was able to avoid the exertio required in swimming to the bottom an up again and he was thus able to conserve his air supply for a much longe period.

More modern "natives" have discarded the lead weight in favour of wedge-shaped stone. They dive in th manner aforesaid, but the shape of th stone enables it to be used as a sort o steering apparatus so that, by manipulating it, the diver can drop right on to the spot as predetermined by looking through a glass or tube from the boat.

LIMITED PERIOD

Generally speaking, such natives dive only in the suit provided by nature so that they are not impeded by extraneous clothing.

Despite all these measures, such divers cannot remain below for periods exceeding about a minute and a half, and the maximum depth to which they dive rarely exceeds about 75 feet.

Some "stunt" men have far exceeded this period of submersion. In 1893, in Melbourne, a cove who called himself "Professor" Beaumont stayed submerged in a tank for four minutes 35 seconds. Another chappie called "Professor" Enoch, in America, sank himself for four minutes 46 seconds, both staying below longer than it took Herb Elliott to run his mile.

All such stunts are made easier (for experts) by the fact that no depth is attained, no energy is used by work, the water in the tanks is warmed and the stunt man has no worry about coming up again.

Over the course of the centuries different types of diving dresses have been devised which enable the diver to get a supply of air for a prolonged period, depending on the depth at which he is working.

Another type of apparatus for diving purposes is the diving bell. This is basically a large container in which the diver works or observes, while being supplied with air. Then there is the caisson, a large cylindrical vessel which is lowered into the water. It is fitted with watertight compartments which are supplied with air and in which the diver works—but more about these anon.

The idea of the diving bell was probably copied from nature, because several creatures use such a gadget under water.

One of the most unique of these is that used by the water spider. He spins a smallish thimble-shaped vessel from his own private silk supply. This is dragged down under the water and anchored by silk threads with the open end down. At this stage it is full of water; but what's odd about this? The spider will soon fix it.

Attached to the hinder parts of the

ider are long hairs with a hook on the d, When the spider rises to the surce he swirls the water, trapping air bbles in the hairs. He then swims nderneath the diving bell, releases the r bubble, which rises into the bell and isplaces some of the water. By repeatg the process the spider gradually fills e bell with air and soon has an airy, atertight home.

Excess carbon dioxide, given off by e spider's breathing apparatus, is dislved in the water and the spider also eplenishes the air from time to time.

The bell is used for hibernating and or hatching eggs from time to time. uring the mating season, the female pider locks herself up in the bell. The ale, thereafter, has a most torrid time, aving to build another bell alongside, en a connecting passage between the wo, so that he can get from one to he other without getting his body wet. lbeit, his intentions may at times be bit dampened.

SPECIAL PROBLEMS

There are various other sea and freshvater creatures which use some kind of living apparatus, but we have said nough about this.

Even when using modern diving aparatus whether they be diving suits, living bells or caissons, it is not just matter of climbing into the water and arrying on regardless. Quite extensive recautions have to be taken to ensure hat the diver is working under suitable hysiological conditions and that he is rought to the surface without suffering physical damage.

Every now and again we read of divrs who suffer from the "bends" and have to be put into what is called a "decompression chamber" under close attention until all danger is past.

The physical conditions governing the art of diving are rather interesting and it is my intention now to describe some of them as simply as possible.

First, it must be understood that water is able to exert considerable pressure, called "hydrostatic pressure." Air also exerts pressure and this is called "atmospheric pressure."

ATMOSPHERIC PRESSURE

Atmospheric pressure is the pressure exerted on everything on earth by the weight of the column of air from the ground to the top of the atmosphere, some miles above. The pressure is about 14.7 pounds per square inch, which we will roughly take as 15 pounds per square inch.

This pressure is called a pressure of one atmosphere. If we compress the air to twice this figure we have what is called a pressure of two atmospheres or 30 pounds per square inch, and so on.

Atmospheric pressure, acting all around us, is not normally noticed because it acts equally in all directions on our bodies. If it is noticed at all it is generally because we have experienced a rapid change in altitude, causing our hearing to be affected temporarily, or our ears to "pop."

Hydrostatic pressure acts in much the same fashion. Salt water weighs 64 pounds per cubic foot, so that, if it was contained in a tank with sides equalling one foot, there would be a total pressure on the bottom of the tank of 64 pounds or 0.44 pounds per square inch.

Now there is a peculiar property of liquids which makes the pressure exerted by it act in all directions.

The search for pearls has provided one of the greatest incentives for men to dive. This collection was won from the sea near Broome, Western Australia.

This means then that not only the bottom of the tank will have this pressure of 0.44 pounds per square inch acting upon it, but there will be pressure on the sides of the box as well, diminishing from bottom toward the top.

WATER PRESSURE

If we have a tank with bottom one foot square and walls two feet high, we will have the pressure of two cubic feet of water pressing on the bottom or a pressure of 0.88 pounds per square inch. Similarly, if we increase the height of the walls to three feet, leaving the bottom one foot square, we will have a pressure of 1.32 pounds per square inch pressing on the bottom.

All this goes to illustrate that it is the depth of water which governs the pressure at the bottom. The other dimensions do not matter.

The pressure on the bottom of a tank 10 feet high is 4.4 pounds per square inch. The pressure below 10 feet of water in a lake is the same as that in the tank. And, if the depth of the Pacific Ocean somewhere is 30,000 feet, the pressure on the bottom will be something like 0.44 x 30,000 pounds per square inch. The greatest known ocean depth is 35,640 feet, so that the pressure at the bottom is over seven tons per square inch!

Obviously enough, there are limits to which a diver can descend unless he is enclosed in a suitable apparatus to minimise the effect of these pressures. It must be remembered, too, that atmospheric pressure is added to the pressure of the water.

CARE REQUIRED

Getting a man in diving dress down into deep water or a worker in a diving bell or caisson takes almost the same care as getting a man up into space.

When it is merely a matter of getting someone down, just to make observations, the matter is somewhat simpler.

In such cases, the observer can be enclosed completely in a strong, steel container provided with observation windows. The observer is subject only to normal atmospheric pressure and the chamber is provided with compressed air cylinders for air supply, an apparatus for absorbing the carbon dioxide given off in breathing and telephone communication to those above. The whole apparatus is lowered by strong steel cables.

This gear goes under various names such as "Bathysphere," "Bathyscaphe," and so on. Depths of over 30,000 feet have been attained with these, the observer suffering no discomfort nor any immediate danger.

With a diving suit, diving bell or caisson, however, conditions are quite different.

When a diver dons a diving suit he is in a flexible suit with a steel or copper helmet. He has weighted boots. The whole apparatus is watertight and

☆

Sixty feet high, forty feet in diameter and weighing nearly twenty tons, this huge caisson was constructed at Amsterdam before the war in an attempt to recover bullion from a vessel sunk off the coast of Holland in 1799.

GOOD CORES TO REMEMBER YOU!

Doughnut-shaped brain cells, each so small that an eyelash could scarcely be threaded through its centre, will help man increase his knowledge and understanding of the earth and universe in 1961.

THIS became apparent with the recent announcement by Lockheed Electronics Co. that it will produce many millions of these tiny cells at its Los Angeles factory this year for a number of computer manufacturers. This makes the company's Avionics and Industrial Products Division one of the leading U.S. producers of brain cells, which are known technically as "ferrite memory cores."

These cells, similar in function to their human counterpart, are integral components of a computer's memory (or brain). It is here that information is stored until needed. The average cost of a cell is just a few cents.

By itself a memory core is a simple device. Those being produced by Lockheed Electronics are from .030 to .080 of an inch in diameter—no larger than a full-stop (.) Hundreds of thousands of these are wired into a computer system's memory. Each is required to remember one answer out of a possible two and feed that answer to the computer upon request.

As simple as this one bit of information may be, when several thousand pieces of data are stored inside a computer there arises a memory system as complex and with as much capacity (and perhaps more) as the human brain.

Lockheed Electronics scientists at the company's Information Technology Division in N.J., foresee the future possibility of a computer for bank use that automatically tells the credit rating and amount of credit the bank can extend to a customer.

When called upon each memory core would answer "yes" or "no" to the question: "On the basis of what you know, should this person's credit be extended?"

Memory cores manufactured by Lockheed Electronics are capable of yielding information at the rate of 250,000 to 500,000 bits per second depending on the complexity of the machine.

The cores, like the computers into which they are wired, are used for an infinite number of jobs. Lockheed Electronics' most recent contract, for example, is for the production of more than one million cores for National Cash Register Co. of Hawthorne, California. They will be used in computers for industry and business.

Another contract is with Lockheed's Missiles and Space Division for cores that will go into the memory systems of computers used in satellite programs. These will be used as part of a system that returns data of space phenomena to scientists on the ground.

air is pumped into the helmet fr above.

It is most important that the suit ab his chest be so arranged that his c can expand and contract with brea ing. This requires that the pressure i side the suit be the same as that on outside, due to the water.

Thus, as the diver descends, air m be fed to him at an ever-increas pressure. At 33 feet the water press is equal to that of the atmosphe namely 14.7lb per square inch. But atmosphere is also pressing on the wa at this pressure, so that the actual pr sure is two atmospheres or 29.4lb square inch. At 132 feet depth pressure is over eight atmospheres 117lb per square inch. At 300 feet is 147lb per square inch.

EQUIVALENT PRESSURE

At whatever depth the diver is wo ing his body is subjected to air pressu equivalent to the water pressure at th depth. If it were not, he would unable to breathe.

In the case of a diving bell or caiss the pressure of air in the compartme is maintained for a different reason.

A diving bell is a large steel be shaped container open at the botto and closed at the top.

A caisson is a large cylindrical vess open at both ends but provided with series of horizontal divisions furnish with airtight doors. These separate co partments act as air locks throu which the workers enter and leave through which material is hoisted to t top.

Diving bells are mainly used for sm underwater undertakings where the me enclosed in the bell, can work on t bottom of a lake or other body of wate

Caissons are more extensive gear us when digging foundations for bridg dams and other similar works.

In both cases, the main purpose the compressed air in the apparatus to prevent the entry of water underneat the bottom edge of the enclosure. A pressure in the enclosure must be least equal to the water pressure at t bottom so that, here again, the men bodies are subjected to the sam pressure.

IN ALL DIRECTIONS

Now let us see what happens to t man under conditions of high pressur

If you drop a brick on your toe yo normally do considerable damage; t brick is not compressible and so exer its pressure only in one direction. Th toe not being supported on the side tends to expand outwards and the weig of the brick bursts the flesh.

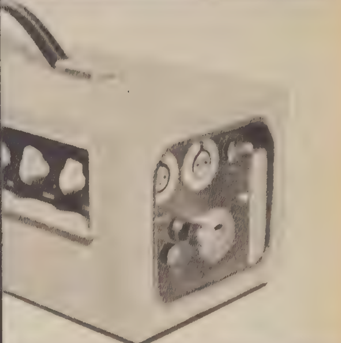
Water and air, being fluids, exert the pressure in all directions at the sam time. A body immersed in either ca adapt itself to a certain extent to th pressure because the body is also, i effect, a fluid.

This is especially true in the case o air, because the air can equalise its pre sure both outside and inside the bod This it does because it has access to th inside through the nose and mouth.

However, if any part of the bod such as a leg, was protected against th pressure, while the rest of the body wa subjected to it, the leg would burst be cause the pressure on the protected par would tend to push that part into th

(Continued on Page 111)

AMAZING VALUE



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This versatile, lightweight (17¼ lbs. incl. batteries) public address system has all the worthwhile features of larger equipment plus the advantages of: easy portability — built-in self-contained power supply — low power consumption — high output (10 Watts) — built in monitor speaker — compact size for easy carrying and storage (14″ x 5″ x 5″).

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Sensitivity *(For Output)* — Micr. 1.0 mV RMS. Gram. 150 mV RMS

Personal Public Address Amplifier

The de Havilland Personal Public Address Amplifier has been designed to cater for the requirements of lecturers, demonstrators, and sporting coaches, etc.

The unit consists of a transistorised package amplifier operating into a five-inch speaker. It is housed in an attractively finished case measuring 8″ x 5″ x 3″, fitted with adjustable carrying straps.

The unit may also be used in conjunction with a microphone with a flexible lead as a low-powered fixed speaker unit.

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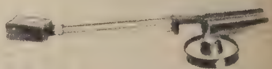

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Technical Review

"ELECTRONIC BRAINS" CREATING MANY NEW JOBS

A great deal has been said about "electronic brains" displacing human labour. The fact is that the rapid adoption of electronic computing devices has created the need for a veritable army of specialists to design, build, sell, use and service them. Already, young people are building entire careers around this rapidly expanding facet of the electronic art.

By Jules Koslow

THE remarkable virtuosity of the computer — the quasi-human prima donna of the electronic age—has almost succeeded in stealing the spotlight from the human performers in the exciting drama of man's effort to increase his analytical powers by harnessing the electron.

Yet is is these performers — programmers, methods analysts, operators—who help supply the human brains that give "intelligence" to the electronic "Brains" of the computer. Without these "computer people," the computer's genius would be largely unrealised.

"The inventors and scientists discovered her and made her a star," a methods analyst recently remarked, "but you might say we put the show on the road and keep it going by clarifying and improving her role to the satisfaction of the paying customers."

Continuing the theatre analogy, it should be noted that it is the programmer who supplies the leading lady with her lines and the operator who push-buttons her to perform on cue according to a well-defined, carefully prepared script.

A composite picture of the programmer and methods analyst reveals that, by and large, he is a man in his 20's or 30's. Seventy per cent of the computer people are under 37, 40 per cent under 32.

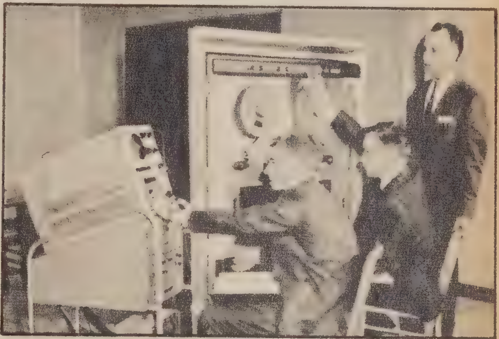
He has a college degree in any of a number of fields ranging from business administration and the physical sciences to English or psychology.

An electronic data processing operation creates jobs and job responsibilities that are new to most businesses. Early users of electronic computers improvised new titles and established job descriptions that appeared to meet their needs best. Selection of personnel has similarly been a matter of experimentation. While companies still seek employees with a good educational background, they no longer feel that a high order of mathematical or electronic ability is required for ordinary business electronic data processing.

Men dominate the field, though women programmers and analysts at all levels are not a rarity.

The number of persons on the staff of a computer installation varies according to the scope of the operation. Small-scale operations may employ only a handful while large-scale computer operations may employ hundreds.

The U.S. Government, for instance, which is one of



These scenes at RCA's Computer Training Centre are typical of training programs initated by other computer manufacturers. At left, a lecture in progress; at right, program training and, top right, maintenance instruction.

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Wholesale inquiries to Henry H. York & Co. Pty. Ltd., Sydney, Melbourne, Brisbane, Adelaide, Perth.

T836

rgest computer users in the country, made a survey of 236 f its computer installations and reported that 3,742 emoyees were required to operate them. Out of this total, o-thirds were engaged in planning and programming, one-urth were operators, and eight per cent were adminisators.

In addition to the thousands of men and women nployed in staffing computer installations, there is a huge my of production workers, sales personnel, specialists in dustry applications and in applied programming, structors, consultants, and service workers. For example, nployment in the production sector alone now accounts r 105,000 persons. In 1956, it was 65,000. Even during cession-ridden 1960, employment in this area rose 10 per nt.

"The computer field isn't for the man who wants to ork on the same old thing over and over again," one dministrator recently remarked. "Each day we're faced with new challenge. You can't amount to much unless in ddition to knowledge and intelligence you've got the most nportant ingredient of all — imagination.

YPICAL WORK PROGRESS

"A man working in computers may start out by workig from detailed flow charts and writing machine-language structions for computer processing. Soon, he may be quired to develop a program for computer solution or rocessing. In addition to preparing detailed flow charts, he ay write machine-language instructions, debug programs, nd test results for corrections.

"Next, he may be given the opportunity to conceive, evelop, and improve automatic programming routines such assemblers, compilers, and so on for specialised utility rograms for debugging and for operational aids that involve rge, sophisticated, or complex computer routines.

"And finally, a limited number may have the chance to rogress into positions where they formulate and plan, in road conceptual terms, original programming applications r large computer systems by using advanced knowledge of cientific, mathematical, or economic disciplines. To do this, ey've got to have a thorough understanding of the new evelopments in computer methodology and technology."

Flanking the programmer and methods analyst is the upervisor or manager of a computer installation, who is igh man on the operations totem pole, and the operator, ho is an integral part of the team.

The supervisor is usually a man who has gone through e rigours of being a programmer and methods analyst. He ay be a supervisor of an installation in business, industry, r government. Or he may be at a computer centre, which upplies services to small and medium-sized firms that do not ave their own computer installations.

The operator seated in front of the computer strikes an rray of keys that trigger the complex mechanism. He—and ften she—may or may not be a college graduate and is sually, like others in the field, in his 20's or 30's.

To meet growing personnel requirements, computer anufacturers have taken the lead in establishing training entres to assist them in filling their own manpower needs s well as to assist computer users in training their personnel. he trainees may be recruited from among college graduates r persons in business, industry, or government working in elated fields.

However, the basic objectives, regardless of where the rainees are recruited, are to teach them what the computer quipment can do and to expose them in a real-life situation o how these techniques work.

Illustrative of a highly efficient training program is the ne conducted at Cherry Hill, New Jersey, by RCA, one of he leading manufacturers in the U.S. of computers, for sales epresentatives, programming and methods analysts, and roduct planning specialists.

College graduates with degrees in any of a large variety f disciplines are eligible. They are selected by means of ests and interviews that determine the candidates' general ntelligence and imagination, as well as educational backround. Experience to date has shown that educational ackground is not always the most decisive factor. One of he best trainees RCA has had majored in animal husbandry!

Training begins with an 11-week classroom work chedule that is both theoretical and practical.

"We try to get the trainee on machines as fast as ossible," says D. H. Kunsman, vice president and general nanager of RCA's Electronic Data Processing Division. "That's where the real test begins. It's a tough course, but the rate of attrition has been low. For example, in a class of 65 last year, only two students dropped out.

Apart from a "hard core" of scientists and engineers with long experience in the electronic art, most workers in the field of electronic computers are young people in their twenties and early thirties.

"After the 11-week training period is over, the trainee may be assigned to a control-point office. He is now a member of a team and may perform a variety of jobs connected with sales. Sometimes, at the control point, a man may be assigned to a customer location.

"During the next nine months, the trainee divides his time about half and half between pre- and post-sales situations. He might be called upon to program, to train others, to act as a captive consultant. At the end of one year, he is then eligible for assignment as an associate in methods programming.

"If he performs successfully in this capacity and shows interest and ability for sales, he then has the opportunity of becoming a salesman."

OTHER TRAINING COURSES

Other RCA-conducted training courses, specifically for persons interested in the programming field, were begun last December at RCA Institutes in New York.

In addition to a 90-hour course for experienced computer programmers, a beginner's course is open to High school graduates who have had one year of business experience such as accounting, office administration, or bookkeeping; those who have completed a tabulating or data processing course at an approved school; or college graduates without previous experience either in business or in tabulating techniques.

From a long-range view, computers are still very much the miraculous prodigies they were a few years ago. In 1954, it was considered optimistic to predict that 50 companies would eventually use these electronic geniuses. Four years later, over 1,200 companies, government units, and the armed forces had installed more than 1,700 computers.

Today, this number has doubled, with about half of them being used primarily for scientific work and the other half for business applications. Surveys indicate that the sales value of computers delivered will increase from an estimated 600 million dollars in 1960 to 1.2 billion dollars by 1965.

For the next decade or two, it is predicted that computers will continue to have the fastest growth potential of any industry in America. To the man in the field, this means he is getting in on the ground floor, and will grow as the industry grows.

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A FURTHER LOOK AT THE

CITIZEN'S RADIO SERVICE

As we had expected, the article in our last issue created a great deal of interest in both private and trade circles. Above all else, it showed that Australia is ready for the introduction of a "Citizens' Band." Not only is the need the same as in the United States but several prospective manufacturers have prototype equipment ready, right now, for commercial development.

By The Editor

TYPICAL of such firms is Weston Electronics Pty. Ltd., of Sydenham Road, Marrickville, N.S.W. Already manufacturing a wide range of equipment for services currently licensed, they had this to say about the article: —

Dear Sir,

Congratulations! Your timely article on the "Citizens' Radio Service" appearing in the August, 1961 issue of "Radio, Television and Hobbies" is very much to the point.

As established manufacturers of radio equipment for aircraft, marine and land vehicle use, we are vitally interested in the development in Australia of communication equipment of the type used in the American "Class D" service.

Highly accurate frequency measuring and other test apparatus, already intsalled, enables us to meet the exacting requirements of aircraft and marine services. The same resources could be applied either to fixed or mobile CB sets.

In order to assist those wishing to do most of the construction work for themselves, but without the necessary precision frequency meter, a sealed frequency control unit, conforming with the regulations standards, could be supplied by this company.

We have, in fact, already designed and constructed prototypes for complete equipments and are convinced that the Australian Electronics industry could produce suitable transmitter/receivers comparable in both price and quality with those available overseas.

We endorse the view that clarification of the official attitude is required and commend you for the very real service being performed by your publication in bringing the matter to public notice.

Yours faithfully,
S. H. Weston,
(Managing Director).

Along very similar lines is another letter to hand from Messrs Commonwealth Electronics Pty. Ltd., of James Street Baulkham Hills, N.S.W. They say:

Dear Sir,

As manufacturers of communication equipment and, more particularly, transistorised hand-carried transceivers for operation in the VHF band, we are extremely interested in official recognition of a Citizens' Radio Service for the Australian public.

In this connection, you are to be congratulated for your timely article in the August issue of "Radio, Television and Hobbies."

As far as we can see, there is no reason why a Citizens' Radio Service should not be provided in Australia right now.

Our company is fully tooled to provide good equipment at short notice and, in fact, we are already supplying substantial quantities of our "Ultraminifone" transceiver to Government Departments, utilities, etc. We are also moving, at the moment, into the export market.

We enclose some photographs of our FM "Ultraminfone" which we feel could be of interest to your readers.

Yours faithfully,
R. S. Hope,
(Managing Director).

From Queensland, a reader draws our attention to the fact that a plea to open up a "Citizens' band" appeared in the April issue of the journal "Amateur Radio" page 61.

While it is true that some feeling has existed in the U.S. between Amateur and Citizens' Band Operators, the fact is that restricted CB operation has whetted the appetites of many to study for their Amateur "ticket," thus providing a welcome potential boost to the ranks of licensed amateurs.

In a personal letter, the writer says:

Dear Sir,

Congratulations on your article in the August issue of "R., TV and H.," on the Citizens Radio Service. It is time a stand was taken in Australia re our "red tape."

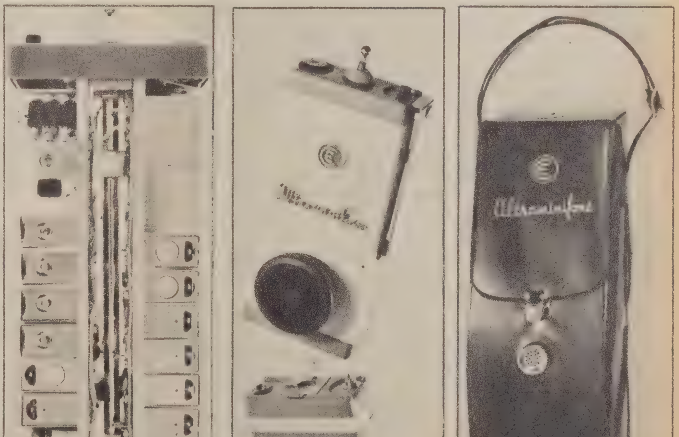
It is to be hoped that the Federal Executive of the Wireless Institute of Australia peruse your excellent article and take the matter up. I intend dropping the VK4 Division a note and ask them to make the necessary representations to the governing body and to make it also an item for the Easter Convention in Perth.

I mentioned this in my W.I.A. notes for April. I also mentioned the increased trade to manufacturers — at that time in the doldrums of the credit squeeze.

Your faithfully,
Bob Wilson (VK4RW.)

Pursuant to the mention of increased trade some idea of the extent of the market in the United States for Citizens' Band equipment is given by a "Buyers' Guide" feature in the August 1961 issue of "Popular Electronics."

The first section of the guide gives photographs and brief specifications of 59 different transmitters, receivers and transmitter-receivers, marketed by 44 different firms. The equipment range in price from 39.95 dollars for a simple home-construction transmitter-receiver kit to 250 dollars for a de luxe unit containging a broadcast band receiver, as well as the Citizens' Band units.



Three views of the "Ultraminifone" produced in Australia by Commonwealth Electronics Pty. Ltd. It would be readily adapted for Citizens' Band use.

NO OTHER
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STEREO 4 TRACK DELUXE
MODEL **M5** . . . 241 GNS.
(Optional extra: The SS.50 matching high fidelity co-axial speaker system)

MONAURAL 2 TRACK DELUXE
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PRECISION DESIGN
Creates precision sound

Fidelity of sound is attainable only through planned refinement in each of an instrument's working parts. This *PRECISION FEATURE* — above all else — singles out the *AKAI* as a superlative recording and playback system. Professional facilities for recording excellence provided by the AKAI include Calibrated V.U. Meter, Editing Pause Lever, Synchronous Motor for constant tape speed, simple wrap-around tape threading, three-digit index tape counter and new exclusive full fidelity (40-20,000 cycle) magnetic heads. Check and compare these features with any other recorder and AKAI will be your choice.

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Every AKAI is supplied with a "sync-rod" which enables recorded sound to be synchronised with movie pictures.

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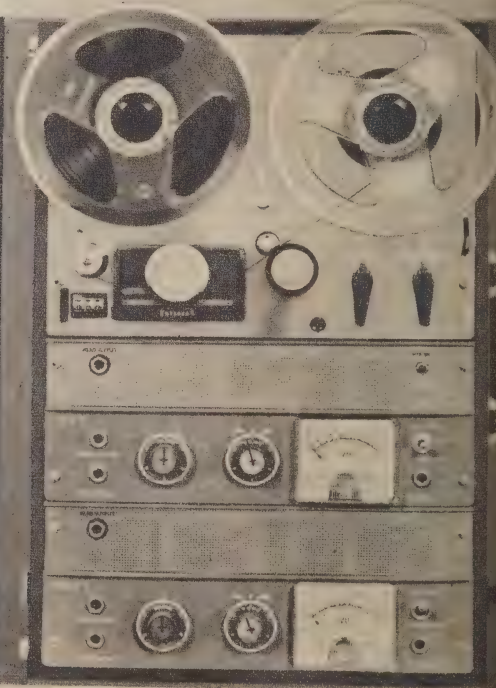
SPECIFICATION FOR M5
(Illustrated)

FREQUENCY RESPONSE: 40 to 20,000 CPS at 7½ ips. 40 to 14,000 CPS at 3¾ ips. **TAPE SPEEDS:** 15, 7.5 or 3¾ ips. **SIGNAL TO NOISE RATIO:** Better than —45dB. **WOW AND FLUTTER:** .07% RMS at 7.5 ips. **TRACK SELECTOR CONTROL:** Precision Indexed Head switching provides the following "inline" facilities — Tracks 1-3 or 2-4 Monaural and either 2 or 4 Track Stereo Record and Replay **MOTOR AND DRIVE:** Balanced hysteresis synchronous motor, belt coupled to speed stabilized flywheel/capstan tape drive. **AMPLIFIERS AND EQUALISATION:** Up to 6 watts per channel at low distortion with record and replay equalisation to Broadcast (NAB) Standards. **CHANNEL SEPARATION:** Better than 80dB at 1,000 CPS. **INPUTS AND OUTPUTS:** Low level, high impedance microphone input; high level line input; high impedance head output. 8/16 ohm amplifier output. **INDEX COUNTER:** Accurate, three digit type. **REEL SIZE:** 7" maximum (up to 2,400 ft. of tape). **DIMENSIONS AND WEIGHT:** 14" x 20½" x 8½"; 47 lbs. **INTERLOCKING CONTROLS:** Prevent accidental erasure of recorded tapes; instantaneous start and split second acceleration. **OPERATING POSITION:** Vertical or Horizontal. **MICROPHONES:** Top quality dynamic finished brushed chrome and black.



S823

Facilities vary a good deal with price ut, for something in the region of 40 to 180 dollars a buyer can expect a ransmitter-receiver capable of sending n about 5 selectable crystal frequencies, eceiving crystal-controlled on as many hannels and, in some cases, the ability o monitor the remaining channels with ariable tuned circuits.

Most equipments use valves, as yet, ut the content of transistors and netallic diodes is rising, with some fully-transistorised equipment being listed. Operation from the 117-volt mains is fairly standard, with accessory power upplies for vehicular and nautical nobile and 32-volt farm applications.

Power output from this equipments group by the way, lies in the region of 150 milliwatts to 5 watts.

In the "under 100 milliwatt" class of equipment, which only needs to be icensed when used with more powerful equipment, some 34 transceivers are isted by about as many manufacturers.

These are invariably transistorised, vith batteries included in the case. Typical prices range from 24.95 dollars for simple gear using a super-regenerative receiver to about 60 dollars, with a superhet receiver, and over 100 dollars for the most advanced designs.

Nor does the market potential end vith actual transmitters and receivers.

Some 17 firms are listed as supplying intenna equipment for the Citizens' Radio Service. Forty-nine different types of antenna are mentioned, including multi-element beams, helical, ground-plane, loaded whips, etc., right down to he humble "rabbit-ears."

CB'ers can pay as little as 9.95 dollars for their aerial or as much as .60 dollars.

Seven firms list microphones aimed expressly at the Citizens' Radio Service, while another five advertise crystals additional to those which would normally be supplied by the equipment manufacurers.

In the way of auxiliary equipment, several firms offer test equipment, mainly aimed at checking antenna matching, power output, etc., though a good deal of general purpose test equipment would also be involved.

Gadgets and special attachments offered include anti-noise filters, a speech scrambler and a selective calling system attachable to all or most existing CB equipment.

No wonder, in the light of all this, hat reference appears in a current ournal to "The CB Boom."

Another interesting facet of the Citizens' Radio Service in the U.S. is the growth of clubs aimed at promoting and co-ordinating CB activities and discouraging misuse of the frequencies.

That misuse has occurred is in no doubt, due partly to ignorance and to ill-advised advertising in the early stages, and partly to the inevitable few who seem bound to abuse any privileges they have, no matter what is involved.

As has happened in the amateur bands, a good deal of voluntary organisation and voluntary policing of the channels is becoming evident. A typical CB Club would take note of abuse of regulations and send a card to the operator involved, drawing attention to the irregularity. Although the Club has no direct authority over the licensee, the fact that his actions are being noted will generally be sufficient to discourage repeat performances. If not, and subsequently the F.C.C. withdraws the licence, there can be no cause or complaint.

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The basis for even a broad general appreciation of this transformation requires that individuals who would progress must have some knowledge of Science and Mathematics. There can be no real appreciation of Science without Mathematics for Mathematics forms the working tools of all modern Science, Technology, Industry and Commerce.

No longer need the subject of Mathematics in all its branches be looked upon with fear and trepidation. Realising the importance of Mathematics in everyday life, in fact **"because everybody uses Mathematics"** twenty-five of the world's foremost Mathematical Professors and Authorities have got together and produced an amazingly simplified method whereby the **"average man or woman in the street, as well as their children"** can obtain with a minimum of effort a thorough understanding of this most important subject, Mathematics.

Not only do Educational Authorities, Departments of Education throughout Australia, Business Leaders, praise this method, but Students, whether at school or the University, Apprentices, Foremen, Mechanics, etc. all who have tested this method are enthusiastic about it.

Although this method of Mathematics has been compiled by twenty-five of the world's leading Professors in Mathematics, it has been written in simple, everyday language for all to understand. A most unusual treatment has been followed throughout in that for the first time in Publishing history, has been included a Dictionary of Mathematical Trms. Not only does this Dictionary cover many pages in alphabetical order but the definitions in the Dictionary are further described by reference to the main text.

Then follow Arithmetic — Algebra — Mensuration — Plane Geometry — the Conic Section — Solid Geometry — Trigonometry — The Calculus — Differential Equations — Statistics — Logarithms — The Slide Rule — Structural Engineering — Machine Shop Practice — Chemistry — Heat — Electricity — Radio — Military Gunnery — Navigation — Accountancy — Finance — Life Assurance — together with 110 Tables and Formulae.

Progress is made certain by the inclusion of self-test problems with answers at the end of each section.

The New South Wales Department of Education writes: **"The Report which is to hand recognises the practical and helpful nature of the treatment of Mathematics."** Department of Education, Victoria, writes: **"All will appreciate the essentially practical nature of the approach to Mathematics."** Department of Education, South Australia: **"The books in their very wide coverage of mathematical ideas and techniques will be particularly interesting."** Department of Education, Western Australia: **"Designed on a 'Teach Yourself' basis and contains many refreshing ideas which should prove valuable."**

People all over Australia and New Zealand are loud in their praise of this exciting new method of understanding Mathematics. The books have been written by recognised leaders in the field of Mathematics to supply the need of Modern Civilisation for people trained to understand Mathematics and Science. Each subject commences from the very beginning assuming that the reader has little or no knowledge of the subject. From this point the subject extends well into University standards. Therefore no previous knowledge of Mathematics is needed.

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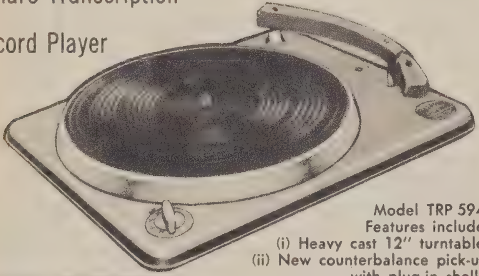

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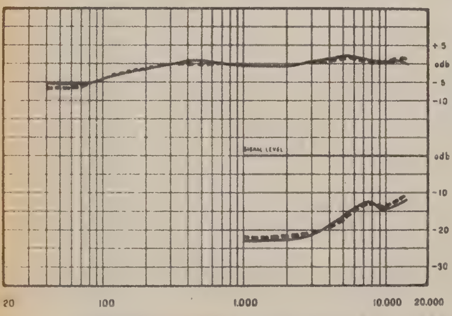

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SCIENTIFIC & INDUSTRIAL NEWS

REDUCING CLOTS

A NEW enzyme is said to dissolve human blood clots. The enzyme self exists in human blood and is lled fibrinolysin. Tests carried out are id to have shown that 45 men and omen suffering from critical heart ail-ents were treated and 39 survived.

The remaining six were in a state of ock, or hopeless heart conditions be-re appearing for treatment. At present e compound is in very short supply d would only be usually given in an nergency. On the other hand research rried out with it indicates that it may useful for other types of illness than art conditions which involve blood ots, as for example phlebitis, an inflam-ation of the vein, and so on.

[Dr Clifton, Cornell University Medi-l College, U.S.A.]

MOISTURE CONTROL

A NEW moisture control unit for use with automatic electronic instru-ents in the paper, textile, food, tobacco d other industries has been introduced Britain.

It is claimed to allow moisture content rcentages previously considered un-easurable to be both measured and ntrolled.

Known as the Moist-O-Graph, it con-ols moisture content by detecting the anges in resistance as the product asses between two conductive surfaces, r example, between a machine roller d a detector roller or a metal chute d a probe.

[Honeywell Controls, Greenford, Mid-lesex, England.]

ANTI-FADE FOR PHOTO TRANSPARENCIES

COLOUR photographs and slides can be made virtually fade-proof in a rocess developed by an American com-any.

The colour shots are bathed in a ansparent chemical solution similar to me suntan lotions. The solution is paque to the ultra-violet rays, which use both sunburn in humans and lour fading in dyes.

The process is reported to leave the xture of the prints and their colour nchanged. In addition, it is so cheap at the company offers to treat all col-ur developing it does without extra arge.

[Berkey Photo Service, 77 E. 13 treet, New York, N.Y., U.S.A.]

DE-SALTING WATER

A NOVEL process is being experimented with for use in de-salting ater which is said to yield a higher uantity of fresh water with a more mpact plant. The process possesses e advantage that the plant is of excep-onally small size. It is claimed by the ientists responsible for developing it at it is only about half the size and eight of many de-salting systems cur-ntly used. The system is said to be ceptionally efficient in operation, and e fresh water it produces is very pure containing only one-millionth part of salt.

The process depends on the use of what is known as "thin film distillation," which takes place in two cylindrical tubes one of which is placed inside the other. Sea water is fed into the tube system from the bottom and is spread by means of a series of blades into a film scarcely a thousandth of an inch thick on the inside of the tube. All the bubbles are removed from the sea water by means of the blades.

Instead of using distillation, the new process uses evaporation by applying heat in the form of steam to a specially designed fluted outside of the tube. As the heat is applied, the thin film of seawater vapour rises in the tube, evaporates, and is converted into pure water by normal scientific processes. More than half the water processed is said to be produced as pure water.

[U.S. General Electric, Schenectady, New York, U.S.A.]

NEW PLASTIC LINING

POLYTILE type BL is the name given to a washable plastic lining for application to the interior surfaces of silos, bins, hoppers and similar storage containers.

In addition to good abrasion resistance, the lining is said to have excellent release properties which prevent materials in granular form from adhering to the container. The lining can be applied by brush, roller or spraygun and will harden off at ordinary temperatures, which, says the maker, means that it can be used in situ in any location. Cost of the material is said to average between 5/ and 7/ per square yard.

[Corrosion, Warsash Road, Warsash, near Southampton, England.]

PREVENTING CORROSION

AN anti-corrosive and anti-moisture agent which has been especially designed for electronic equipment, and is supplied in the form of an aerosol dispenser unit, has been developed in Britain.

Tests are said to have shown that the compound will penetrate holes, cracks, pores and displace the moisture in them which has already been absorbed. When this moisture has been driven out or eliminated the compound, moreover, forms a film to prevent further contamination. It is claimed that this film does not become brittle and it is an active, or beneficial, lubricant on moving parts. It can also be used to treat equipment already exposed to excessive moisture.

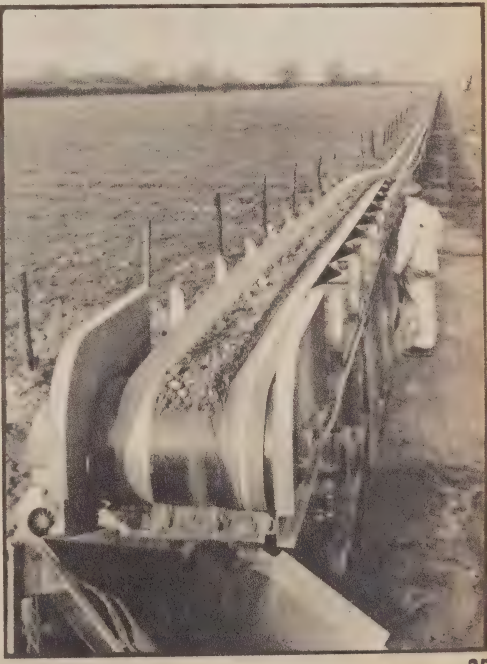
[Hellermann Ltd., Crawley, Sussex, England.]

MODIFIED GALVANISING

MAGNESIUM added to the zinc galvanising bath is reported to increase corrosion resistance by factors ranging from 20 to 90 per cent in an American process which is also claimed to make the galvanising operation easier.

If aluminium is added to the magnesium-zinc bath, the steel plate is given a satin-white coating.

The amount of magnesium needed is



Over 2000 feet in length and 24 inches wide, this above-ground conveyor belt carries 200 tons of sand and gravel per hour at a gravel quarry at Bodymoor Heath, Sutton coalfield, England.

Made by a British Company from a four-ply "Terylene" / cotton fabric, the rubber covered belt is not only stronger than the cotton belts previously used but it is also cheaper.

Previously three belts and two transfer points were necessary. Now one man is stationed at each end of the belt. They keep in touch by field telephone.

MAGRATHS

ANNUAL STOCKTAKING SALE

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MAGRATHS

BASEMENT, 208 LT. LONSDALE ST. MELB.

inute—only from 0.03 to 0.05 per cent the zinc. The aluminium concentra- on is even smaller—0.003 per cent to 004 per cent.

[Dow Chemical Co., Midland, Michi- an, U.S.A.]

ELECTRICALLY-CONDUCTIVE PAINT

ROM Japan comes news of an electrically conductive paint said to pro- de a coating with good conductivity, igh mechanical strength and excellent exibility.

The paint consists of a mixture of ery small metallic particles and slightly rger granules of thermoplastic resin ispersed in a liquid. Although the quid does not act as a solvent—the ranules are not actually dissolved in it -it can be evaporated from the coated rface by the application of heat. This eating also causes the resin granules to se and act as a binder for the metallic articles.

The manufacturer states that the paint an be applied to almost any surface—cluding cloth—and, if special care is ken, an electrolytic coating can be plied on top of it.

[Nippon Telegraph and Telephone ublic Corp., 2 Aoi-Cho, Akasaka, inato-Ku, Tokyo, Japan.]

TOUGH SYNTHETIC "PAPER"

NOW being produced in Switzerland is a tough, washable, synthetic aper which is claimed to have excep- onal mechanical strength.

A new chemical process is used for s manufacture and the material is said compare most favourably with paper ade from rags or wood pulp. It can e written on, printed or painted and is vailable in a variety of weights and olours.

Its strength (claimed to be much more an that of paper made from conven- onal materials) is said to make it espe- ally suitable for maps, season tickets, unched cards and milk cartons.

[Zurcher Papierfabrik an der Sihl, iesshubelstrasse 15, Zurich, Switzer- nd.]

CAR BEARINGS

A BRITISH firm is experimenting with making car bearings that will ever wear out. A research team is ex- erimenting with bearings that float in cushion of oil in the same way as the overcraft floats on a cushion of air.

With practically no friction, bearings in e car of the future should produce ore efficient, smoother running and wer petrol costs, as well as providing e motorist with a car in which there re parts which should never wear out.

HIGH-TEMP. GREASE

AS technology extends its frontiers with the help of unusual metals nd the running of machinery at higher nd higher temperatures so new or modi- ed lubricants become necessary. A lub- icating grease is really a highly viscous il. As the temperature rises, so the rease softens and eventually melts. rom time to time, additives have raised he possible working temperature. The ewest is silica, added to a new lubricant alled Molytherm.

It can be used for continuous service bove 350 degrees Fahrenheit, going up 550 degrees Fahrenheit for short eriods. Having a higher drag than the earlier greases, Molytherm should be used below 250 degrees Fahrenheit only if there is sufficient power. Molybdenum disulphide provides the lubrication. The grease is resistant to steam, water, acids and alkalis.

[Rocol, Rocol House, Swillington, Leeds, England.]

NEW MATERIAL

A NEW thermo-electric material is said to be capable of withstanding temperatures of more than 2,000 degrees Fahrenheit.

It is a ceramic type compound based on the use of samarium sulphide. Tests have shown that it is exceptionally efficient in operation over a wide range of temperatures. It is expected to be especially useful as a medium for converting heat directly into electricity, and for use in systems for refrigeration in both houses and industrial plants.

[Westinghouse Corporation, 3, Gateway Centre, P.O. Box 2278, Pittsburgh 30, Pennsylvania, U.S.A.]

JET INJECTION

A NEW technique for administering injections without the use of hypodermic syringes is said completely to eliminate the use of sharp pointed, hollow needles.

In the new system vaccines and other materials are forced under high pressure through a tiny opening in the injection device. This produces a stream of vaccine or other materials that will painlessly penetrate the surface of the skin.

[U.S. International Corporation Administration, Washington 25, D.C., U.S.A. (Richard L. Towle).]

HIGH-SPEED RELAY

CALLED the B.14, a new electrical relay measures 1 inch by 15/16ths inch by 1-3/32nd inch and weighs only one ounce.

Because of its small size and speed of operation (3 milli-seconds) the relay will have many applications in industrial and domestic equipment, it is claimed. Equipment in which the device could be used is said to include remote control systems for television sets, flasher units for cars and vending machines.

[B. and R. Relays Ltd., 9 Ormond Close, Boswell Street, London, W.C.1., England.]

RUBBER POROSITY

ONE of the problems in the manufacture of vulcanised rubber has been in the fact that porosity occurs. This is caused by volatile substances given off during the curing, by air being trapped in the rubber, or by moisture. Since it can affect the quality of the rubber, it has become especially important to find a solution.

The solution has been found by the use of a special calcium oxide and mineral oil compound, which is said to absorb an exceptionally high percentage of its own weight in water. This material can be added to rubber or to plastics in proportions of about three to eight parts of the compound per 100 parts of the rubber or plastics.

The compound is an odourless paste which can be poured readily at room temperatures and can be incorporated without difficulty into rubber compounds.

[John and E. Sturge Ltd., Wheeleys Road, Birmingham, England.]

Magnetic Sound INDUSTRIES

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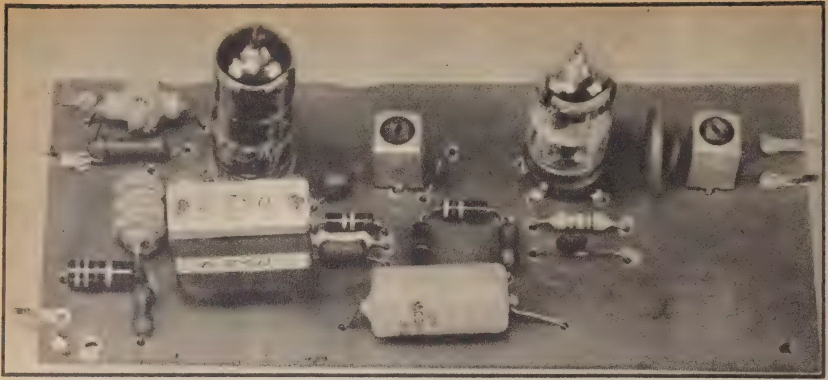


The above illustration shows the component layout for our new "Basic Converter." The crystal shown in the unit was used to "lock" the 7Mc amateur band into the "Q6er" described in the December, 1960, issue.

From 1.6 Mc. to 60 Mc. with the R. TV. & H.

BASIC CONVERTER

Here is a simple, basic, converter design which can be used on any frequency between 1.6 and 60Mc. Construction is simplified by the use of the printed circuit form of wiring and complete coil data is given for the entire tuning range.

By Keith Jeffcoat

THAT there is a need for such a unit is apparent from the number of requests we receive for converters on odd frequencies outside the range which we have already covered in the past. A typical example is the number of recent requests for a unit to cover 1,750 Kc, the new station used by the University of N.S.W. for broadcasting lectures to students.

Another example is the numerous requests for receivers covering the frequencies used by small ships, bush fire and civil defence networks and the specific short-wave bands covering overseas broadcasts.

A number of such broadcasts are within the 6 to 18 Mc coverage of the average dual-wave receiver. Not everybody has such a unit, however, and, in any case, their performance is often below the standard required for reliable reception of the aforementioned broadcasts.

This is not to say that such sets suffer from poor design. Their shortcomings are due to the compromise which the designer has to accept when he attempts to obtain short-wave coverage from a medium-priced unit intended primarily for broadcast-band reception.

In order fully to cover the broadcast band, these sets have a tuning capacitor with a minimum capacitance of about 20 pF and a maximum of over 400 pF, together with a dial mechanism having a fairly small reduction ratio, so that the band is covered without overmuch knob twiddling. When this large gang capacitance and low dial reduction is used for the short-wave bands it results in rather poor L/C ratios and very touchy tuning, particularly at the higher frequency end of the band.

One way of circumventing these shortcomings is to use a converter that will heterodyne the desired shortwave band down to a frequency within the normal broadcast coverage of the receiver. In this way the limitations of sensitivity tuning rate, image rejection and so forth, can be considerably reduced and while performance will still lag (mainly in selectivity) behind that of a full-blown "communications" type receiver, it is certainly a much less expensive proposition.

Though we have featured a number of converters in the past they were mostly designed for one specific band or bands, and were not easily adapted for coverage outside these bands. With this unit we have given complete coil data for all frequencies through to 65 Mc. The choice of which band of frequencies is to be covered is up to the individual constructor.

The actual bandwith between the 6 dB down points which can be covered with the converter coils set for any one frequency, will vary from 50 Kc at the lower frequencies (1.6 Mc) to 3 Mc at the upper limit of 65 Mc. This is a characteristic of all fixed tuned converters and ours is no exception.

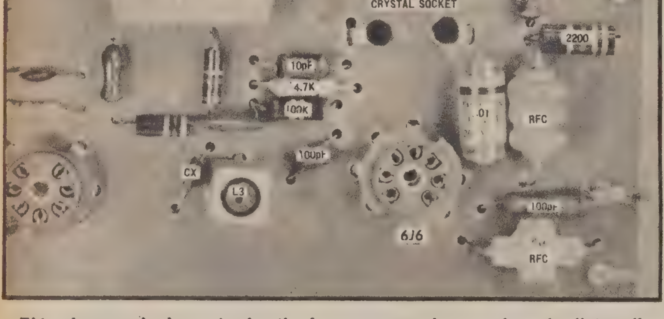
All of the parts used in the unit are available through radio trade houses, including the materials used in the printed board, and it is possible that ready-made boards may be available by the time this article appears in print.

Use of the printed form eliminates the possibility of wiring errors and makes construction of the unit possible by even the relative newcomer to the field of radio. A full-scale drawing of the printed board is included and it is only necessary to place this over the board to be etched and trace through it with the aid of a piece of carbon paper.

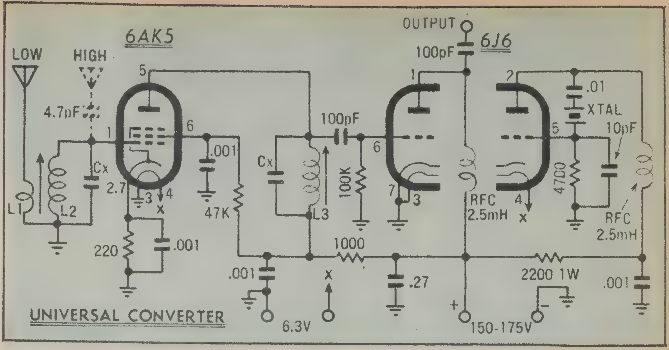
The "fixed tuned" style of converter, which includes also the "crystal locked" principle, was chosen in preference to the tunable variety for a number of reasons, viz.:

(1) The unit has no tuning controls and therefore may be located out of sight, probably inside the cabinet of the radio with which it is to be used.

(2) Because it has no tuning gang and



This photograph shows, in detail, the component layout when the "pierce" or fundamental type oscillator is used. The choice of a crystal and a matching socket is left to the individual. In our case the DCII type holder was used.



Here is the main circuit diagram in its conventional form for those who may prefer to construct the unit on a metal chassis in lieu of the printed circuit method. Provision is made for either a high or low impedance input. The output, being untuned, may be taken at any frequency which suits the receiver you use with the unit.

sociated dial, the unit may be considerably smaller in size than the usual nable converter. This lack of a dial d gang capacitor also means a conderable saving of expense.

(3) The conversion oscillator, when ystal controlled, has maximum frequency stability, a point which is highly sirable when SSB or other similar odes of transmission are to be copied.

(4) The tuning dial of the broadcast ceiver is used and, if it is calibrated Kc's and a crystal of known frequency used in the converter, fairly curate frequency calibration is posble.

(5) The problems of "touchy" tuning e overcome because of the greatly panded tuning rate which is available. hort-wave stations can be tuned with e ease of the local broadcast stations r, to quote a friend, "you can tune it ith a pair of boxing gloves on."

It may be as well at this junction to ok at the circuit of our unit, commencing at the input end.

Provision has been made for the use f either a high or low impedance aerial. the aerial is of the "doublet" type it ill have a nominal impedance of 70 hms and should be connected to the rminal shown attached to L1.

If, on the other hand, it is of the ngle wire feed variety and has a fairly igh impedance, it can be connected in e manner shown by the dotted lines. this case it will be necessary to drill hole at the extreme edge of the printed ircuit board, install a lug in it and onnect a 5pF capacitor from the lug pin 1 of the valve socket.

The coils L1 and L2 are wound on tandard Ducon pot-core type formers or frequencies up to 10Mc and Ducon scillator coil formers housed in the potore can for frequencies from 10 to 5Mc. These formers are ideal for the ob as they have been especially designed or use in printed circuitry.

A second, and most important conideration is that, being fully "potted," hey eliminate the possibility of oscillaion caused by the inductive coupling between the input and output tuned circuits of the RF amplifier valve.

In point of fact, the converter was found to be completely stable over its entire tuning range and, due to the printed circuit form of construction, anybody who constructs it can reasonably be assured of the same performance.

While the coil formers we used were supplied by the Ducon organisation, other formers which have the same physical dimensions and electrical characteristics could doubtless be used.

The capacitor CX connected across coil L2 depends on the frequency to be covered and values are given in the coil data chart.

The RF amplifier valve is a sharp cutoff pentode type 6AK5. It was chosen because it is a preferred type, in plentiful supply, and has an internal noise figure which is always below the static level for the frequencies which the unit is designed to cover.

The coil L3 in the plate circuit is tuned to the same frequency as L2 and, except for the winding L1, has the same number of turns and parallel capacitance, CX, as L2.

The amplified signal at the plate of the 6AK5 is coupled through the 100pf DC isolating capacitor to the mixer grid in the 6J6 twin triode mixer-oscillator valve. The plate of the mixer is fed from the HT line through an RF choke of 2.5 millihenrys in lieu of the usual tuned IF transformer. If a tuned circuit were to be used at this point it would need to have an extremely low Q figure in order that its performance should be equal over the band which it is to cover and a circuit with such a low Q could contribute little or nothing to the overall performance of the unit anyway!

As the majority of broadcast sets are designed for a high impedance aerial, output from the mixer is taken through a 100pF capacitor directly from the plate, which is a high impedance point. This output terminal should be connected to the aerial terminal on the broadcast set through a shielded lead which is properly earthed at both ends. If this is not done, there is a strong possibility of "breakthrough" from the local broadcast stations when the set is being used for shortwave reception.

The second half of the 6J6 is the oscillator used to heterodyne the incoming signal down to the tuning range of the broadcast set.

As shown in the main circuit diagram this is a "Pierce" type crystal oscillator. However, by replacing the RF choke with a tuned circuit at three times the crystal frequency, changing the grid resistor from 4.7K to 10K, placing a 50pF

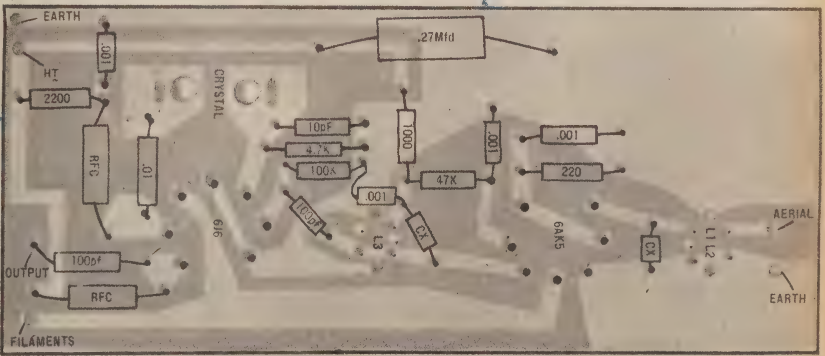
PARTS LIST

RESISTORS

1 220 ohm, ½ watt.
1 1,000 ohm, ½ watt.
1 4.7K, ½ watt.
1 2.2K, 1 watt.
1 47K, ½ watt.
1 100K, ½ watt.

CAPACITORS

1 10pF ceramic.
2 100pF ceramic.
4 .001Mfd ceramic.
1 .27Mfd paper 200 volt.
1 .01Mfd paper 200 volt.
2 ceramic (cx) to suit L2 and L3 as per chart.
2 7-pin valve sockets.
2 2.5mH. RF chokes.
2 Pot-core coil former (see text).
1 Suitable crystal.
Printed circuit board, solder lugs, 6J6 and 6AK5 valves, crystal socket pins, quantity of 39B&S enamelled copper wire.



This diagram of the rinted circuit board vith the components uperimposed on it will be of assistance when assembling the nit. Where the vertone oscillator ircuit is to be used, reference should be nade to the diagrams on page 31.

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Above with Decca FFSS pickup. £10 extra. With Ortofon stereo pickup, diamond stylus, complete with head and transformers, £15 extra. With Orpheus turntable, £7 extra.

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apacitor in series with the .001 plate ypass capacitor and connecting the side f the crystal which normally goes to e plate to the junction of the .001 and e 50pF, it is changed to a "Robert oller" type overtone oscillator.

A comparison of the circuit of Fig. 1 ith the main circuit diagram will show e changes involved, while a glance at e photograph showing the wiring of he respective sections for each mode ill show the physical layout for each ethod.

For frequencies up to 12Mc it is nvisaged that the unit would be used ith the Pierce type fundamental oscillaor. Above this frequency fundamental rystals become expensive and increasngly harder to obtain, so the overtone scillator should be used with a crystal f approximately one-third or one-fifth he desired oscillator frequency (preferbly V cut). By so doing, it is possible o obtain crystal control right up to the aximum useable frequency of the conerter.

For those who may possibly find the ost of a suitable crystal somewhat of burden (in some cases this could equal he cost of the rest of the converter omponents), it is entirely feasible to ubstitute a tuned circuit to replace the rystal in the Pierce circuit. For the ower frequencies (say the aforemenioned 1,750Kc broadcasts), this arrangenent would be quite satisfactory and, in ases where low frequency crystals are lifficult to obtain, may even be preferble. However, for the higher frequenies, stability would be somewhat of a roblem and it is not recommended, at east for critical listening.

The photograph of a tuned circuit nounted on two pins sawn from an old alve base shows a unit which would lug directly into the crystal socket and ubstitute for a crystal. This unit was ried on frequencies up to 65Mc and scillated quite well over the entire range, hough it did suffer from a certain deree of frequency shift.

One of the major advantages of using crystal is the degree of certainty with hich one is able to pinpoint the posiion of desired shortwave broadcasts on he receiver dial.

As an example of this, let us suppose hat we wish to receive an overseas roadcast on a known frequency of ,205Kc and that we know the crystal n our converter to have a frequency of 6,305Kc. By subtracting the oscillator frequency (6,305Kc) from the station frequency (7,205Kc), we arrive at 900Kc and this is the spot at which we could logically expect to find the station on the broadcast receiver.

For this reason alone, it is felt that the initial expense of a suitable crystal is well worthwhile for many applications.

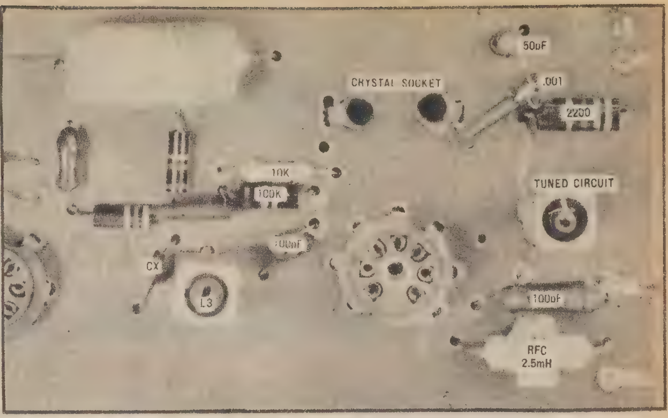
There is no coupling capacitor shown between the oscillator and mixer sections of the 6J6 as it was found that, under all conditions, sufficient mixing took place due to the internal coupling within the valve.

A power supply has not been included in the unit, because it was felt that many receivers would be capable of supplying its modest power requirements. The filaments will require 6.3 volts at .625 amps, while 150 volts at 25 milliamps is required for the HT.

Do NOT, under any circumstances, connect directly to the HT line in your receiver if the voltage is in excess of 150 volts, as it is most likely to be. The HT voltage in the average receiver is usually in the vicinity of 250 volts and, should this prove to be so in your case, a 4,000-ohm 5-watt resistor placed in series with the line to the converter will drop the supply to 150 volts.

This then just about covers the actual circuitry involved, now we can commence with the construction of the unit and the most logical place to start would be with the manufacture of the printed circuit board.

By the time this article appears in print it is entirely possible that boards for the unit will be available through local supply houses. If you are not of



Illustrated above is the component layout for the overtone type of oscillator circuit. Comparison can be made with a fundamental type shown on page 28.

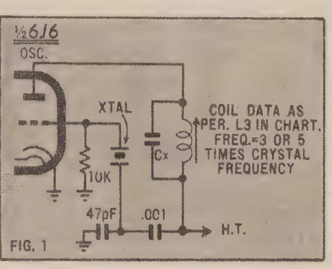
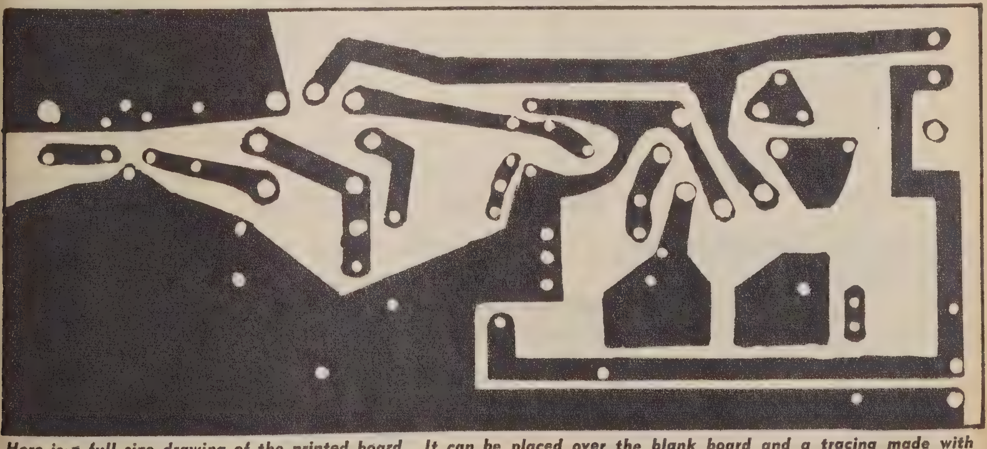

½6J6
OSC.
XTAL
COIL DATA AS PER. L3 IN CHART. FREQ.=3 OR 5 TIMES CRYSTAL FREQUENCY
Cx
10K
47pF
.001
H.T.

FIG. 1

This is the circuit of the overtone crystal oscillator suggested for use on the higher frequencies.



Here is a full size drawing of the printed board. It can be placed over the blank board and a tracing made with the aid of some carbon paper and a ball-point pen.

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1961 Karset	R. TV & H.	TRD160	TRS163
Electronic Stethoscope	R. TV & H.	TRD108	TRS168

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TRS109	0.5	375 C.T.	3.5
TRS108	0.5	300 C.T.	3.5
TRS133	1	93 C.T.	3.0
TRS168	1	84 C.T.	3.5
TRS120	1.5	20 S.E.	3.5
TRS163	1.5	20 or 5 S.E.	3.5
TRS105	10	33 C.T.	15
TRS119	10	33 C.T.	500,250,125

TRANSISTOR **DRIVER** TRANSFORMERS

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TRD 160	SE to SE	8000	20
TRD 107	SE to PP	3000	1300 C.T.
TRD 108	SE to PP	3000	2000 C.T.
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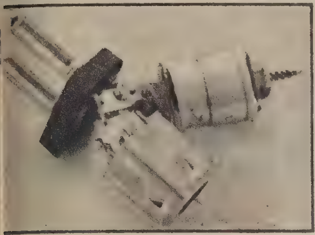
Perth — Athol M. Hill, Durham House,
842 Hay St., 21-6987.

mind to "roll your own" you may pre-r to purchase one of these boards ady made, in which case, the follow-g description of their manufacture may bypassed.

A complete description of the etching printed circuit boards was published the June, 1961, issue of the magazine



If necessary the crystal could be replaced with a tuned circuit as illustrated above, though this is not recommended for critical applications above 4Mc.

it, for those who may not have this sue easily to hand, here is a resume the procedure.

The experimental kitsets which are ailable for this will contain the fol-wing materials: A piece of copper minate (the size will depend on which t you buy), a bottle of etcher (ferric loride), a bottle of liquid flux (resin methylated spirit), and a bottle of tumous paint to be used as a "resist." ssuming these materials to be on hand u should proceed as follows:

Cut a piece of the laminate to the re-iired size of 2¾ by 6½ inches. Stan-rd commercial practice for this opera-on is to use a preheated guillotine and eheat the material, but this is a bit uch to expect of the home construc-r. A satisfactory home job can be ne by clamping the laminate in a vyce tween two pieces of wood and saw-g with a fine hackshaw blade. The t should be made from the copper side and any rough edges dressed with a file.

The next step is to trace the circuit pattern on to the copper. First cut a piece of carbon paper to the same size as the board and place it with the carbon surface next to the copper of the board. Over this is placed the full-size reproduction of the printed circuit. This can be either cut from the magazine and taped in position or the board affixed to the page while still in the magazine. Either way it should be FIRMLY fixed so that there is no possibility of movement during the tracing process.

For good clarity, tracing is best done with a ball-point type of pen. A sharp-pointed instrument should be used to mark each of the holes to be drilled in the board.

Using both the traced lines and the original drawing as a guide, the pattern is picked out with a small artist's brush, leaving a small (1/16in) circle clear around each of the prick marks donating a hole to be drilled. Care should be taken with the spacing between lines, particularly where high voltages are involved. If the resist paint appears too thick for easy working, it should be thinned by the addition of a little turps.

Any mistakes may be wiped out with a piece of rag soaked in turps, remembering that it is a good deal easier to

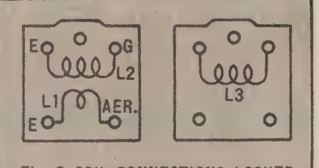


Fig. 3 COIL CONNECTIONS LOOKED UPON FROM UNDERSIDE OF BOARD

The coil connections shown above should be strictly adhered to where our printed circuit layout is to be used.

COIL DATA

FREQUENCY	COIL	CAPACITANCE
1.6 to 1.9Mc	24 turns on Q1 pot core	270pF
1.9 to 2.2Mc	„	180pF
2.2 to 2.6Mc	„	127pF
2.6 to 3.1Mc	„	82pF
3.1 to 3.7Mc	„	50pF
3.7 to 4.3Mc	12 turns on Q1 pot core	140pF
4.3 to 4.9Mc	„	100pF
4.9 to 5.8Mc	„	70pF
5.8 to 6.9Mc	„	47pF
6.9 to 8.0Mc	6 turns on Q1 pot core	156pF
8.0 to 10Mc	„	100pF
9.6 to 15.0Mc	18 turns on Q2 osc former	100pF
15.0 to 24.0Mc	„	33pF
24.0 to 30.0Mc	4 turns on Q2 osc former	100pF
30.0 to 38.0Mc	„	65pF
38.0 to 46.0Mc	„	39pF
46.0 to 57.0Mc	„	22pF
50.0 to 65.0Mc	„	5pF

NOTE: This data applies to both L2 and L3. All coils are wound with 39 B&S enamelled copper wire.

COIL DATA FOR L1

L1 is wound first on the bobbin in the case of the pot-core formers, with the two "earthy" ends nearest to each other, and at the earthy end of L2 in the case of the oscillator type formers.

FREQUENCY	COIL
1.6 to 3.7Mc	4 turns
3.7 to 6.9Mc	2 turns
6.9 to 10.0Mc	1 turn
10.0 to 24.0Mc	4 turns
24.0 to 65.0Mc	2 turns

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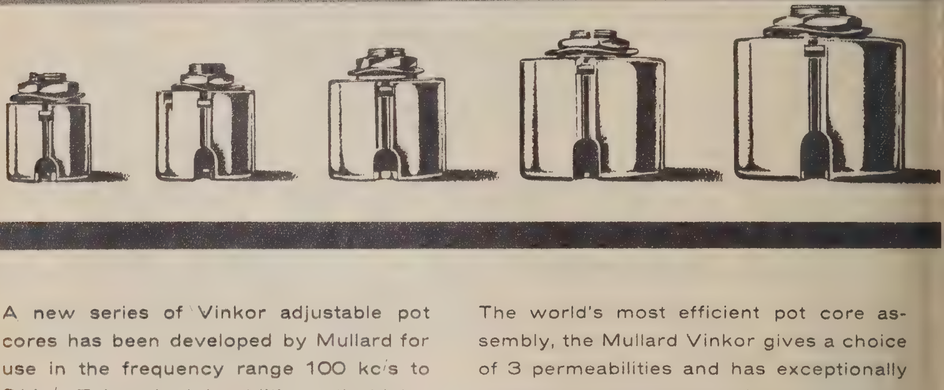

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MT112

rrect mistakes in paint than in cop-r.

The drilling of the holes is best complished before etching away the plus copper. The valve socket holes 1-8in, crystal socket 3-16in and all ers 1-16in. Drill from the copper e, use a sharp drill and avoid excess essure, which may tend to tear the pper away from the bakelite.

Having produced a pattern in resist d drilled the necessary holes, the next is to etch away the unwanted copper. e ferric chloride as supplied with the will consist of small yellowish brown nps which, though quite hard, will solve readily in water. The optimum ength for an etching solution is given four to six ounces of ferric chloride a pint of water. The proportions are t unduly critical, though too strong or weak a solution is likely to work wly, as well as being uneconomical.

At a temperature of 75 degrees F the ite should be completely etched in 35 nutes. This time will be less at higher nperatures and some authorities commend 90 to 120 degrees as a good rking temperature.

While commercial installations use borate methods of agitation it is suffi-nt that the plate is completely covered d the dish rocked occasionally. Photo-aphic dishes made from moulded bake-, enamel, stainless steel, etc., are quite isfactory or, alternatively, pyrex glass wls or pie dishes from the kitchen may used, provided they are washed care-ly afterwards.

ATER RINSE

After etching, the board should be sed in water to remove the etchant d then swabbed with mineral turps to move the resist paint.

Copper can be somewhat difficult to der to if it is tarnished, so before plying the resin and methylated spirit x it is a good idea to clean the board giving it a quick rub with metal lish and wiping clean with a cloth ked in methylated spirit.

This completes the construction of the ard. The next step is to assemble the rious components into position and der them in place.

The drawing showing the position of se components on the printed board ould facilitate this operation, and it felt that further comment is unneces-y, except perhaps to clarify the situa-n regarding the valve and crystal kets.

Normal type of valve sockets are not itable for printed board use. The type ed are specially made for the job and s point should be stressed when you der parts for the unit.

During the construction of the printed cuit board, you will no doubt have ticed that no hole positions were rked for the crystal socket. This was t an oversight on our part, but was ne deliberately. Crystals suitable for unit are available in many different lders, each having different pin sizes d spacings. A sufficiently large area copper has been left on the board accommodate all these sizes and the tual position of the holes is left to individual constructor.

Sockets are available for the newer " type and FT243 crystals and if such crystal is used the appropriate socket n be used. Sockets for some of the ler type of crystal holders are no ger available, however, and where ch a crystal is used two holes should be drilled in the board corresponding to the pin spacings of the crystal and pins taken from an old wafer-type valve socket fitted in the holes to take the crystal.

It would be a long job to describe the construction of suitable sockets for the multitude of different crystals available, so this part of the job is left to the ingenuity of the individual constructor.

Before wiring in the crystal oscillator, it will be necessary to know which type (overtone or fundamental) is to be used and this will depend on the frequency band you wish to cover.

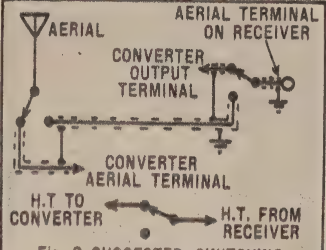
AERIAL
AERIAL TERMINAL ON RECEIVER
CONVERTER OUTPUT TERMINAL
CONVERTER AERIAL TERMINAL
H.T TO CONVERTER
H.T. FROM RECEIVER

Fig. 2 SUGGESTED SWITCHING SYSTEM FOR USE WITH CONVERTER

Where the converter is to be a permanent installation, the above circuit can be used to switch in or out of operation.

The average broadcast receiver covers from 550 to 1,600Kc and will usually have frequency as well as station markings on the dial. Its actual frequency coverage then is 1Mc or 1,000KC and this is the range which can be covered on any of the shortwave bands. The approximate centre of the BC sets range is 1,050Kc, so the converter crystal should be chosen to bring the centre of the chosen shortwave band out of the converter at a frequency of 1,050Kc. An example of how crystal frequency is chosen for each type of oscillator follows:

Suppose the centre of a chosen band is 6,285Kc. Fundamental crystals around this frequency are easily available and quite cheap, so the fundamental or Pierce oscillator shown in the main circuit diagram would be used.

DIRECTION OF TUNING

It is desirable to have an increase in received signal frequency correspond with an increase in frequency on the BC sets dial. To do this, it is necessary to have the crystal oscillator on the low side of the incoming signal. To this end, then, the centre frequency of our BC set (1,050Kc) is subtracted from the centre frequency of the chosen band (6,285Kc), leaving 5,235Kc as the necessary crystal frequency.

As a second example, let us suppose we wish to cover a much higher frequency, say 28,300Kc. If we were to use the Pierce oscillator, we would need a crystal having a frequency of 27,250Kc and such a crystal, as well as being difficult to obtain, would be quite expensive. The best method in this case is to use the overtone oscillator (circuit Fig. 1) and a crystal having a frequency one-third of the desired oscillator frequency of 27,250Kc (i.e., 9,083.3Kc).

For frequencies above 30Mc it is suggested that the fifth overtone be used, in which case you would choose a crys-

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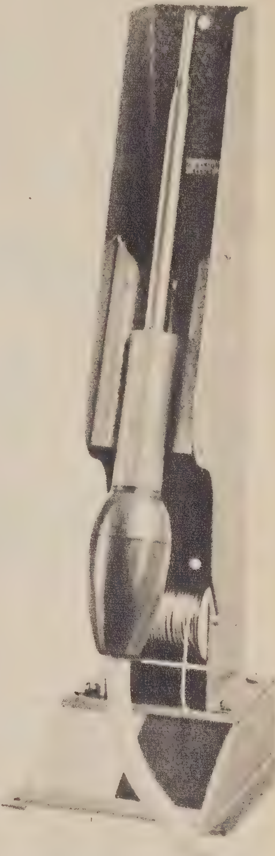

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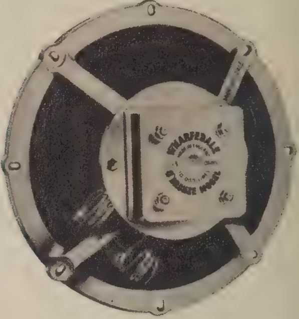

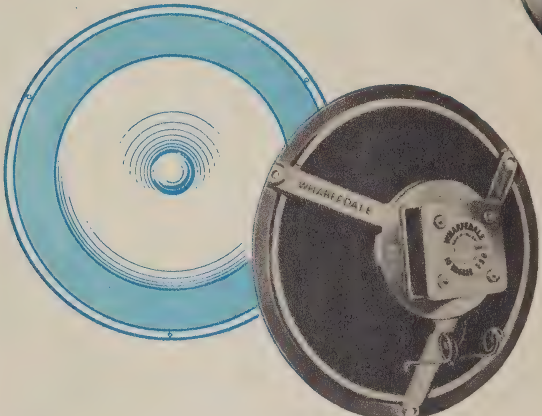

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10" Bronze FSB	30/38	10,500	12	30-10,000	£11.0.0
10" Golden	60/70	14,500	20	50-12,000	£15.15.0
Golden FSB	30/38	14,500	16	30-12,000	£17.2.9

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having a frequency one-fifth of the ;ired oscillator frequency. In either ;e, when using the overtone oscillator cuit, the tuned circuit in the plate the oscillator valve should be reso- nt at the desired oscillator frequency d NOT at the frequency of the crystal.

After completion of the wiring, etc., next step is to connect into the re- iver's power supply, as previously men- ned, and align the tuned circuits for iximum signal. Provided there have en no mistakes made in the construc- n of the printed board, the placing components and the winding of coils, unit should produce some output ien first switched on.

Where the Pierce oscillator has been ed, there is little possibility of non- cillation, provided the crystal used is t defective. With the overtone cillator, however, the tuned circuit will ve to be adjusted to resonance before cillation takes place.

DJUSTMENT

One method of adjusting this oscillator to connect a VTVM or other sensitive ltmeter to the oscillator grid and adjust r near maximum voltage. When justing this circuit, it will be noticed at there is a slow rise in grid voltage til a peak is reached and then by rning the slug perhaps a half a turn ore the circuit will suddenly drop out oscillation.

It is best to set the oscillator on the wly rising part of the curve at a point st prior to the maximum voltage which n be obtained. If the oscillator is set r absolute maximum output, there is possibility that oscillation will be any- ing but reliable.

Ideally, alignment of the tuned circuits and L3 should be carried out with signal generator and an output meter the usual manner. If these facilities e lacking, good results can be obtained merely peaking the circuits by ear r maximum output when the unit is ned to one of the stations within the sired shortwave spectrum.

HIELDED CONNECTION

Mention was made at the beginning this article of the necessity for mak- g the connection between output ter- inal of the converter and the input ter- inal of the receiver in co-ax cable. It ould be a nuisance to have to make is connection each time the converter used and it is customary to provide me form of switching circuit to over- me this problem. Such a circuit is own in Fig. 2. All wiring to this itch, except the HT, should be in ielded lead to minimise breakthrough.

This then completes the description of hat we hope should prove to be a popu- r and versatile little converter. We ve tried to anticipate all or most of e uses to which such a converter could put and design accordingly, but it es occur to us, even at this late stage, at there is a further way in which its rsatility could be improved.

Not so long ago, it was common actice to make shortwave communica- n receivers with plug-in coils and ough our unit has the tuned circuits 1, L2 and L3 wired to the board there no reason why they should not be ade to plug in to a suitable socket.

There is no reason, in fact, why a t of plug-in coils should not be made d suitable crystals obtained to give mplete coverage of the entire range.

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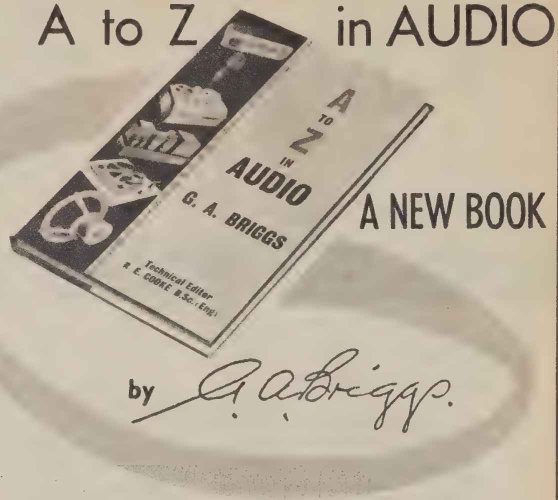

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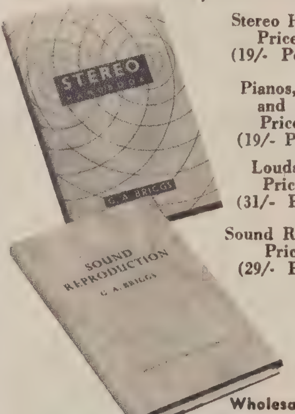

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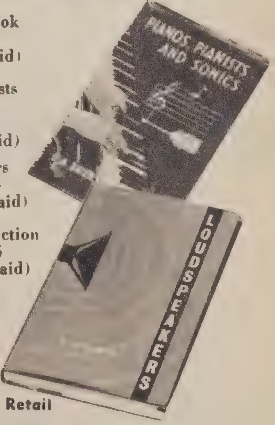

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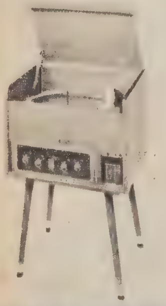

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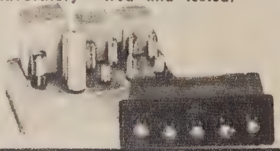

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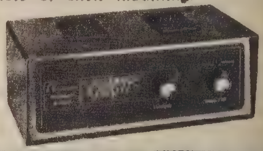

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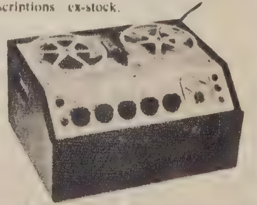

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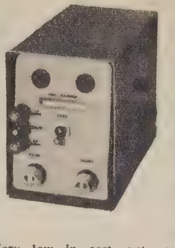

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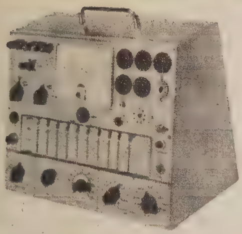

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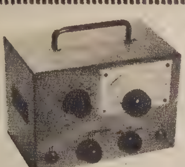

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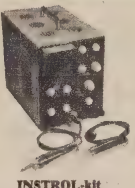

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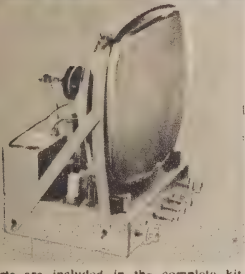

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This month the topic for discussion is the transistor and its operation. Starting from fundamentals and the germanium crystal lattice, the discussion proceeds with the operation of the P-N junction and its properties, and concludes with the junction transistor.

By JAMIESON ROWE

IN the first article of this series, we learned the atomic theory of the structure of matter, and how the various chemical elements are formed with differing numbers of electrons, protons and neutrons in their atoms. All atoms consist of a nucleus of protons (positive charge) and neutrons (uncharged) around which a number of negatively charged electrons "orbit."

The orbiting electrons of every atom are imagined as being grouped in "shells" or "rings." In atoms of a particular element, the number of electrons in the outermost shell of each atom is of particular interest, since it determines many aspects of the behaviour of the element, both chemically and electrically.

Considering solids in general, the element concerned will allow current to flow easily through it in the form of passage of electrons if it has a small number of electrons in its outer shell. It is then called a conductor.

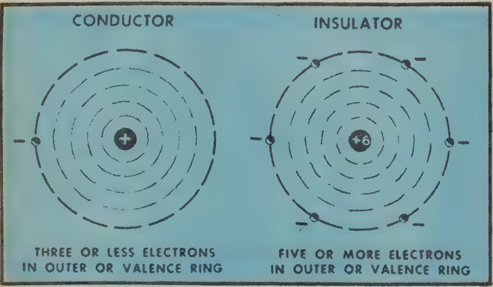
CONDUCTOR
INSULATOR
THREE OR LESS ELECTRONS IN OUTER OR VALENCE RING
FIVE OR MORE ELECTRONS IN OUTER OR VALENCE RING

Figure 1

If, on the other hand, it has an outer shell containing a number of electrons either near or equal to the maximum allowable number (usually eight), electron passage through the element is much harder to produce, and the element is called an insulator.

This may be imagined as a mechanism whereby, the more outer shell electrons there are, the more strongly they are attached to the atoms and the more force must be applied to free them, for conduction to take place.

Certain elements exhibit conductive properties approximately midway between conductors and insulators, such as germanium and silicon. These elements have four electrons in their outer shell, as one would expect from their behaviour, and are accordingly called "semiconductors." The class of semiconductors does not include only elements, by the way, for certain compounds of elements exhibit the same properties.

Figures 1 and 2 show diagrams representing the atoms of a conductor, an insulator and the semiconductor germanium. They should be considered as representative diagrams only, not pictures of atoms.

In a lump of a substance, the atoms or molecules (smallest existent group of atoms) of the element or compound comprising it are bound together. There are a number of possible types of bond, but the type of bond which we need consider here is that which occurs in many semiconductors, including germanium. This type of bond is called "covalent bonding" and is shown diagramatically in figure 3.

Here the dotted circles represent the outer or "valency" shells of each of the nine atoms shown (the inner shells are omitted for clarity). Note that each atom shares each of its four valency electrons with the neighbouring four atoms. Thus any two atoms are effectively "sharing a pair" of electrons, and each atom has effectively eight electrons in its valency shell. This produces a very stable bond, as the fully occupied shell of eight electrons is very stable.

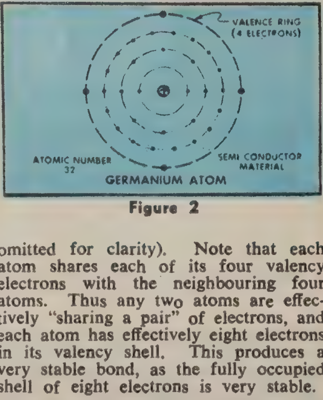

Figure 2

Germanium atoms arranged as in Fig. 3 in a typical pure crystal are taken to be in a "lattice," as the diagram wou suggest.

As one would expect, pure germaniu having this lattice structure has a rath poor conductivity, as all the outer sh electrons are employed in intra-atom bonding. If small amounts of other el ments are added to the germanium controlled impurities, however, the co ductivity may be greatly increased. Th may occur in two ways, by adding o of two types of impurity elements.

For instance, if a small amount of element having not four, but five ele trons in its outer shell (such as pho phorus, arsenic or antimony) is adde conditions such as that shown in Figu 4 arise in the lattice.

The impurity atom joins in the latti structure and forms covalent bonds wi the surrounding four atoms, but is st left with a "spare" electron. Thus th type of impurity is called "donor" in purity, as its addition results in fr electrons, which are available for cu rent conduction through the lattice. Ge manium crystal with a small quanti of donor impurity is called "n-typ germanium, to signify that there a conduction electrons available.

"ACCEPTOR" IMPURITY

The other type of impurity which ma be added is one which has only thr electrons in its outer shell, such as bo on, aluminium, gallium or indium. Wh small quantities of such an element a added to the germanium, conditio such as those shown in Figure 5 appe in the lattice.

Here again the impurity atom joi in the lattice structure, but in this cas it is only able to enter into covale bonding with three of the surroundi

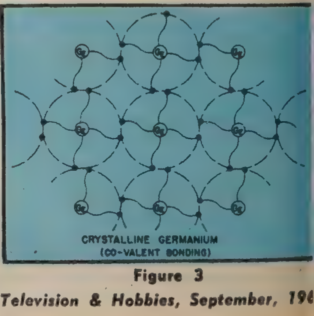

Figure 3

oms. There is no fourth electron to are with the remaining atom, so a fect in the form of an electron vacancy "hole" is set up.

It happens that such holes are able "travel" throughout the lattice from om to atom, in much the same way as e electrons do in the n-type german-m. Thus under the influence of ther-al (heat) energy or light energy or an ectric field, they move around the lat-e, and constitute a flow of positive arge. Germanium, which has this pe of impurity (called "acceptor" im-rity) is termed "p-type," to signify at conduction is by the positive holes.

Note in passing that once the extra ectron of an n-type impurity atom has andered from it, the atom becomes sitively charged (i.e., a positive ion) ce it now has insufficient electrons to lance its positive nucleus. It is fix- in the lattice so that it cannot move, that if the electrons are removed om the crystal, it will be left with a tt positive charge.

Conversely, in p-type germanium, if ectrons are supplied to the crystal — so visualised as the removal of holes the crystal is left with a bulk nega-e charge, due to the impurity atoms ving one too many electrons (i.e., they e negative ions). It should be realised at although the impurity ions are im-rity atoms which have altered their ectron "complement," they are still ns OF THE IMPURITY ELEMENT, nce chemical composition is determin- by the structure and particles of the cleus.

So much for the concepts of n-type d p-type germanium. We are now in position to examine the operation of simple p-n junction, as used in semi-nductor diodes and rectifiers.

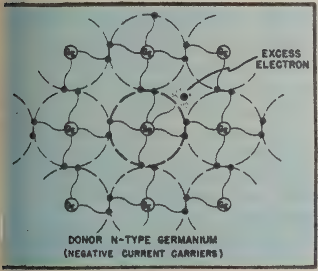

Figure 4

Consider Figure 6, which shows dia-rammatically a p-n junction consisting f a piece of p-type germanium and a iece of n-type germanium side by side the same crystal structure.

At normal temperatures, the current rriers (holes in p-type, conduction ectrons in the n-type) wander freely roughout the lattice due to thermal ergy, some of them wandering across e junction. If a current carrier from ne side wanders over the junction, there a good chance that it will meet a rrier of the other type and neutralise em both.

For instance, if a conduction electron om the n-type side wanders into the type, it may easily meet a hole and ll or annihilate it. Similarly, when a ole appears in the n-type region, it may sily meet a conduction electron and ncel it as before.

Due to this action, there is a section f the crystal surrounding the junction which has little or no carriers. This is called the "depletion layer," for obvious reasons.

In the p-type section of the depletion layer there are no holes present, and thus there is a nett negative charge present (due to the impurity atoms having one electron more than normal, and there being no holes elsewhere to cancel out the negative charge). Similarly, the depletion layer in the n-type section acquires a nett positive charge, lacking its balancing electrons. These effects are shown by the curve marked "CHARGE."

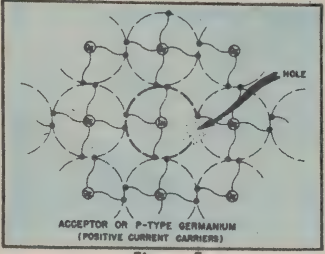

Figure 5

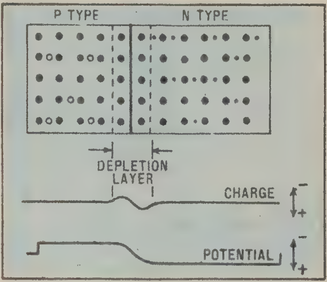

Figure 6

Due to this setting up of charge concentration across the junction, a potential difference is created between the p-type and n-type sections, as indicated by the curve marked "POTENTIAL." The p-type section is negative with respect to the n-type section. When this charge concentration and potential difference is set up, further carrier wandering across the junction is inhibited, since the carriers are repelled by like charges.

If we try to pass a current through the junction and crystal by applying a voltage having similar polarity to the depletion layer potential, as in (a) of Figure 7, we merely add to the depletion layer potential, and no current flows. This is called "reverse biasing."

On the other hand, if we apply a potential which is opposing the depletion layer potential (Fig. 7 b), the two potentials oppose and a current will flow. This is called "forward biasing."

Obviously, the p-n junction exhibits unilateral (one-way) behaviour of much the same sort as the thermionic diode valve. Thus in the form of the semiconductor diode (with germanium, silicon, or the older selenium and copper oxide types), the p-n junction finds many uses as a rectifier, detector, etc.

The junction transistor is a logical step from the junction diode, as it consists basically of a crystal structure which incorporates not one but two junctions. Obviously, there would be

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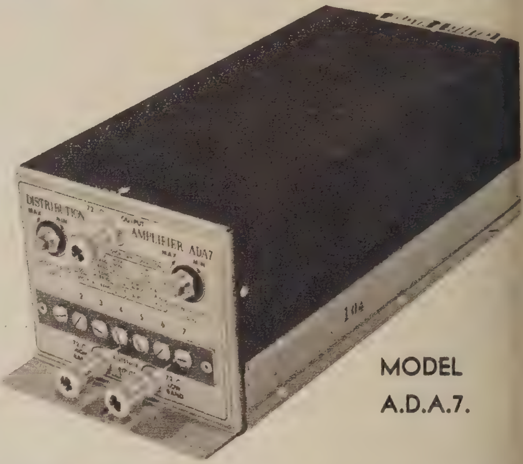

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vo possible "variations on this theme," one having a p-n-p onfiguration, the other an n-p-n.

This proves to be the case in practice, and transistors having oth types of configuration have appeared in great quantities. owever, the p-n-p type is the most popular for general applica- ons, at least at present and in this country. Thus, since both perate in a very similar fashion, we will deal only with the n-p type.

Consider Figure 8, which shows a diagramatic representation f such a transistor. Note that it consists of two p-type regions eparated by a somewhat thinner region of n-type.

One p-n junction, between the collector and base regions, is ased in the reverse direction, and thus would normally pass a ry low current. The other junction, that between the base d emitter regions, is forward biased and passes current quite sily.

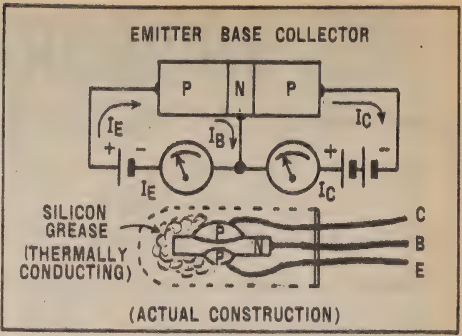


Figure 8

Due to the fact that the two junctions have the thin base gion in common, the following things happen: holes drawn cross the emitter-base junction by the forward bias present quire a certain velocity, and are also tracted strongly by the negatively harged collector region on the other de of the base-collector depletion layer. great many of these holes continue ross the depletion layer, rather than ave the crystal at the base region.

Thus there is a nett base-collector hole urrent, produced solely by the effects the emitter-base hole current. This represented on the diagram by Ie, Ib d Ic, where Ie equals Ib plus Ic. Since ith normal transistors Ib is a relatively nall proportion of Ie, Ic and Ie are pproximately the same.

IMILAR CURRENT

Note that in the actual construction of e transistor, the collector-base junction large whereas the emitter-base junc- on is small, even though both pass ap- oximately the same current. This is ecause the collector-base junction is verse biased, and is effectively a high npedance. In other words, for the same urrent as the low impedance emitter- se junction it will dissipate much more ower. The emitter-base voltage may only 100 millivolts, for instance, hereas the base-collector voltage is of- n 9 volts. The collector-base junction thus made larger so that it can deal ith the increased dissipation without ndue heating.

The controlling effect of the emitter- se current upon the base-collector cur- nt enables the transistor to be used an amplifier. This is because a small nange in the current Ib is accompanied a large change in base-collector cur- nt, Ic. Since the ratio of the poten- als involved is also relatively large, oth effects combine to produce sub- antial power amplification.

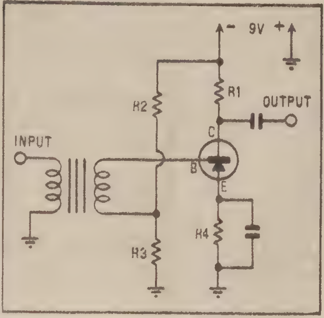


Figure 9

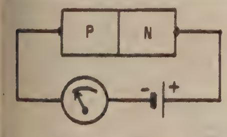
Figure 9 shows a typical transistor nplifier circuit, with the transistor con- ected up in so-called "common emitter" configuration. The input signal is superimposed on the base current, and the output voltage developed across the load resistor R1.

The quiescent base current is set by resistors R2 and R3, which form a voltage divider across the battery. A divider is used to stabilise the current (rather than a simple series resistor) because of a factor which was not stressed in the foregoing explanation of transistor operation.

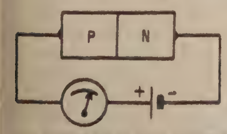
In all germanium there is a certain number of current carriers generated by thermal action, etc. Thus in a piece of p-type germanium there is always a small number of electrons available for conduction, and in n-type a small number of holes. These thermally generated carriers are obviously in the minority in these regions, and are accordingly called "minority carriers." They increase in number with the ambient temperature, as one would expect from their origin.

Minority electrons produced in the collector region of the transistor shown in Fig. 9 are attracted over the junction into the base. Thus in normal operation there is a small leakage current over the base-collector junction, called Icbo. If the base potential is not stabilised by a fairly low impedance voltage divider as shown(or various other methods), the base potential will change because of Icbo.

As it happens, the bias change tends to increase the emitter-collector hole current and increase the transistor dissipation. The transistor thus tends to increase in temperature, which increases Icbo, etc., etc., etc., and the transistor may "run away" and destroy itself. Bias stabilisation in transistors is thus a matter of great consideration.



(a) REVERSE BIASED -NO CURRENT



(b) FORWARD BIASED-CURRENT FLOW

Figure 7

In closing, there is another factor in the transistor operation which has not been mentioned as yet. This is that the forward resistance of the emitter-base junction is roughly inversely proportional to temperature. As you may realise, this too will affect the bias stability of the transistor. Thus in many cases a resistor (R4 in Fig. 9) is placed in series with the emitter to "swamp out" this variation. It is usually bypassed with a capacitor to prevent AC current feedback and consequent loss in gain.

Well, Tom, this brings to an end our somewhat brief discussion of transistor operation. Next month we will examine the ways in which the various transistor characteristics may be measured and tested.

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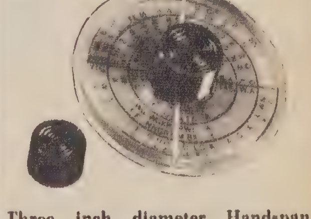

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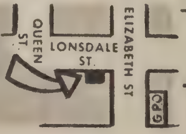

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Even the humble retaining nut and ck washer should not be neglected. It es not take a genius to check, and if cessary, tighten such nuts while the assis is out of the cabinet, but it is tally important. A control which works ose a few weeks after a service job will use an owner untold annoyance, and ill create just as much bad will as the ost complex electrical fault. So don't erlook these "important trifles."

The dial, of course, has always been e biggest single problem. Some of the nfigurations produced in the past, while positive delight to a slick talking salesan, could only be described as a servicean's nightmare. Happily, the trend in cent years has been towards the simpler yle. Or so I thought until a few days o.

The story started when an attractive enage lass pushed a transistor portable ross the counter and complained that was no longer possible to tune it corctly. More exactly, she explained that, though the knob still turned, the pointer oved only erratically, or not at all. She so added that this had been getting proessively worse over the past few weeks.

IT LOOKED SO SIMPLE

Well, that seemed straightforward ough. I made a quick check of the mptoms, mentally diagnosed a stretched al cord, and advised the customer to ll back the following day. At that age I had no idea the job would prent any unusual problems.

The set was by a well-known local anufacturer, and was a fairly convennal portable, as distinct from the pernal portable type of thing. As such, was large enough to justify a fairly aborate and attractive dial, "straighte" style, mounted at the top front of e cabinet. The tuning knob protruded om the right hand side of the case.

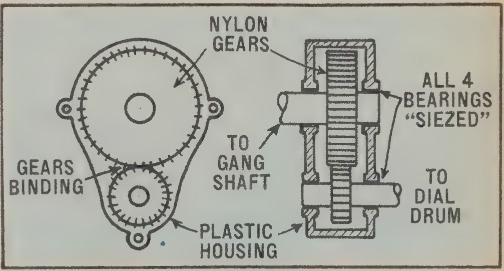
The set was a fairly recent model, id my only encounter with others of its pe had amounted to nothing more than utine replacement of batteries and milar jobs. I had never had occasion study the dial mechanism in detail and d imagined it was a conventional cord d drum arrangement.

It took a few minutes to find all the rews which held the chassis in the binet, but I was happy to note that e chassis and dial, with the exception of the dial glass, were all in one ece. Also, as far as I could see at is stage, it was still a conventional rd/drum combination.

It was only when I had removed the chassis completely from the cabinet and examined it in detail that I realised that this assumption was only partly correct. True, there was the usual drive shaft, pulleys, pointer slide, drum, and spring loaded cord, all in the normal configuration. The difference concerned the manner of coupling the drum to the gang shaft.

Instead of the one being mounted directly on the other, the drum was offset by an inch or so while, between it and the gang, there was an unfamiliar device; a little pear shaped "box" about 1¾in long and ¾in thick, and made from white plastic. It obviously contained some form of drive mechanism.

What was more important, this seemed to be the seat of the trouble. It was immediately obvious that the drive cord was not slipping in the normal sense, but only because it was tugging at some obstruction. Further investigation showed that neither the drum nor the gang plates could be moved directly by any reasonable application of pressure. Whatever was in the plastic box, it appeared to be jammed tight.



Much binding in the gearbox. The all plastic unit used in a current portable, showing points of seizure.

Next was the question of how best to attack this box. It appeared to have a lid on the drum side, held in place with three small self-tapping screws. Before I could reach these, or make any other checks, the drum would have to be removed.

Unfortunately, removing the drum meant releasing the tension on the dial cord, and I am no more anxious than the next fellow to "de-string" a dial unnecessarily, if I can avoid it. On the other hand, it was no use duckshoving the issue; the drum had to come off.

In such circumstances, there are a couple of tricks which can be employed to retain most or all of the original stringing, thus saving much time and temper later on. The one I used on this occasion is simple but quite effective where it is only necessary to retain the stringing around the dial; quite sufficient in many cases.

All that is required is a stout rubber band which is stretched across the drum so that it lies along the diameter. In some cases more than one band may be advisable. A variation on this theme is to use sticky tape in one of its many forms, and this is useful in more complicated setups where a number of positions need to be retained.

Removal of the drum—it was held in the conventional manner with two grub screws against the shaft—revealed that the shaft, like the box, was made from plastic, presumably nylon. It also provided access to a screw in what appeared to be a second shaft, coupled to the gang. The screw passed through the length of the shaft and tapped into the end of the gang shaft.

Removal of this screw allowed the whole plastic box assembly to be lifted free. It also confirmed any lingering doubt there may have been as to where the system was binding. The gang now moved freely, but neither of the shafts in the box would budge.

One reason why they wouldn't budge became evident when I removed the three self-tapping screws and attempted to remove the lid. The two bearings in the lid were extremely tight; so tight, in fact, that I had to force a table knife under it and exert considerable force—and care—to get it off in one piece.

As I more or less expected, the "works" consisted of two nylon gears, one small, one large, obviously aimed at improving the reduction ratio of the dial drive. However, for some reason not yet clear, the shafts were "frozen" in all four bearings. These were so tight that, once they were separated, there was no chance of reassembling them.

In fact, my first impulse was to dump the whole lot in the garbage can and order a new gear box from the manufacturer. On the other hand, there were several good reasons why it would be worthwhile to try to salvage it. For one thing, having reduced the set to several pieces, I naturally preferred to get it back together, rather than have to shelve it until a new part arrived.

For another thing, this was Thursday and I had more or less promised the owner she could have the set the following day in time for the weekend. It was hardly likely that I could organise the delivery of a new part in time to honour this and, while failure in this regard would no doubt be treated quite tolerantly, one does like to keep faith wherever possible.

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So I took another look at the nylon ts. If I could somehow reduce the aft diameters or increase the bearing ameters, it might still be possible to ake the thing work. The problem was, ow to tackle it. Abrasives, such as nery or glass would seem to be out, nce a smooth surface would be needed ensure free running.

The better approach would be a sharp itting edge which could peel off a yer of material. And, as I didn't feel ry confident about my ability to re- ice the shaft diameter and retain a asonable "round," it seemed that the arings were a logical choice.

However, there was one aspect which ould not be ignored. The shafts had bviously been under compression in the earings and, once removed, had ex- anded appreciably, while the bearings ontracted, thus contributing to the dif- culty of reassembly. To overcome this decided to chamfer each leading edge ightly, using a fine file.

Returning to the bearing problem, I oked over the available tools for some- ing suitable. The most likely weapon emed to be an odd three-cornered file, e end of which had been ground nooth, forming a scraper.

A tentative try confirmed that, with little care, it could be made to remove in shavings of material and still leave e smooth surface needed to act as bearing. Naturally, I took my time oout the job, checking frequently with e shaft which was to fit each hole. fter all, material once removed is gone rever, and too sloppy a fit would be st as bad as one that was too tight.

MORE TROUBLE

Even while the bearings were still nduly tight, I managed to replace both ears for a rough check. And it was just s well I did, because another problem resented itself. As well as binding in e bearings, the gears were binding gainst each other, exactly as if the bear- ngs were too close together.

Immediately I realised this, the whole icture suddenly became clear. In simple rms, the case had shrunk, reducing oth the size of the bearings and the istance between them. And now that I ame to look more closely at it, it ap- eared that the case could have been ade from a different type of plastic om that used for the gears.

But, whatever the cause, I now had a econd problem to solve; how to shift e centres of the bearings. Fortunately, ese still needed considerable paring nyway, so I concentrated on the appro- riate side in each case, trying my best make the hole larger, with a new entre, rather than simply elongated.

I don't know how a precision fitter ould have assessed my efforts. I can nly say that, in due course, I achieved n acceptable result. The shafts ran eely in the bearings and the gears eshed as they had been intended to. nd after all, it's results that count.

From there on the procedure was retty much routine, being simply a atter of getting everything back to- ether again. The fact that, due to the ubber band around the dial drum, I ad a minimum of dial cord stringing do helped considerably.

However, I feel bound to say that I as not particularly impressed by the ial system. Quite apart from the prob- em already discussed it seemed to suffer om several conflicting mechanical orces. In particular, the cord tension pulled the dial drum at an odd angle relative to the line of the shaft, inflicting further strain on the nylon gearbox.

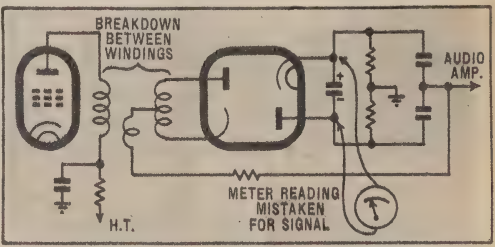
All in all, I felt that it would have been a better job without the gearbox, in spite of the added reduction ratio this was intended to provide.

On the credit side was the manner of attaching the pointer to the cord. This was held by three small "fingers" on alternate sides of the cord. It held the pointer firmly, yet not so firmly that it could not be shifted with reasonable pressure. And, by accident or design, it was possible to apply such a force with the end of a screwdriver, after the set was in the cabinet. It made the final alignment and dial calibration relatively easy.

☆

A broken down ratio detector coil in a TV sound system. In addition to causing distortion, it gave a misleading meter reading on test.

☆



I must admit I gave a sigh of relief when it was all finished. For the very good reasons I have already stated I had felt obliged to go on with this job once I had started, but I wouldn't like to make a regular practice of it.

The next time, knowing what is inside the gearbox and what this means, I will know better than to start it. It will be much easier and cheaper to place an order for a new one, and base my delivery date to the customer on this approach.

Finally, there is the all-important question: why did it happen? Was this an isolated case or is the design and/or the material used unsuitable for the job. If the latter, will all models eventually suffer the same fate and, more important, what is the solution? After all, fitting a new unit which will eventually fail in the same way is hardly solving the problem.

However, I imagine that will be somebody else's headache.

My next story concerns the sound section of a TV set. This is not a prolific source of anything unusual, most sound troubles being simple routine faults involving valve failures and the like. For this reason, anything out of the ordinary is generally worth reporting.

The set was a home-made one—possibly to one of the R., TV and H. designs—and had been in use for some time with complete satisfaction. Then, quite suddenly, according to the owner, the sound had become weak and distorted.

Although he had built the set, the owner, on his own admission, was ". . . no great shakes at servicing." Apart from replacing doubtful valves, he preferred to leave well alone. However, he had been able to deduce that the trouble was not in the audio section, thus narrowing it to the sound IF and ratio detector.

Acting on this assumption he had obtained and fitted a new 6AU6 IF amplifier and 6AL6 ratio detector. When these had no effect he decided to seek my help. Happily enough, from my point of view, he did this by bringing the complete chassis into the shop. Whenever it can be managed I always prefer the facilities of my own bench to what can be improvised in the customer's lounge-room.

A test on the bench confirmed the owner's complaint. It was very weak and very distorted. My immediate impression was that the alignment of the ratio detector coil had slipped badly, which seemed the most likely cause of such a condition.

Accordingly, I set things up for an alignment check of the whole sound IF system. Unmodulated 5.5 Mc signal from the generator was fed in at the sound pick-off point, and a meter was connected across the ratio detector stabilising capacitor. I noted that the latter read about 15 volts as soon as I connected it, and mentally registered that this was a fairly normal reading for this set-up.

Unfortunately, the situation did not remain normal for long. Adjustment of the slug in the ratio detector coil made not a scrap of difference to the meter reading, nor did adjustment of the generator input level. Finally, I disconnected the generator completely, but the 15 volts was still there.

Thinking that the 6AU6 IF amplifier might be "taking off" for some reason, I removed this also, but with precisely the same effect. It wasn't until I removed the 6AL5 that the mysterious voltage vanished.

A little more detailed probing with the meter revealed the cause. A voltage of 150 or so was present on the secondary winding of the ratio detector transformer; a value which immediately suggested a breakdown to the main HT supply for the IF strip.

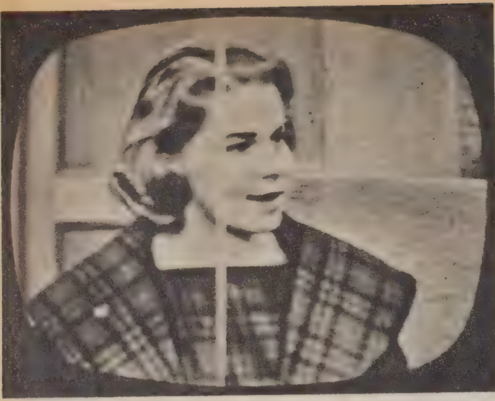
DEAD SHORT

Sure enough, a resistance measurement between primary and secondary showed a virtual dead short. Since it was fairly easy to remove the can I was able to make a detailed examination of the "innards" without disturbing things unduly, whereupon the reason was immediately apparent.

It was a common fault. The two relevant leads were resting against each other for half an inch or so, securely held with impregnating compound, and obviously broken down at some point. As I peeled the two apart, with the ohmmeter still connected, the short vanished completely.

A few minutes' work with the soldering iron and some short lengths of light sleeving was all that was required to make the coil as good as new. Not only did I save the cost of a new coil, but the repair was easier than a replacement would have been anyway.

All I had to do then was touch up the alignment, and the set was ready for the customer.



PART THREE

Taken from our 1959 receiver, this photograph illustrates the condition which occurs when excessive drive voltage is applied to the Horizontal Output stage. A distinct whitish line is clearly evident down the centre of the screen.

Completing The R. TV & H. 1961 TV Set

Assuming no serious wiring errors, the majority of constructors should have, by this time, some sort of a picture on their new TV receiver. The picture may be far from optimum as regards linearity, width, etc. and it is the purpose of this final article to describe, in some detail, the adjustments necessary for good picture quality.

By Alan Nutt

THESE adjustments correspond fairly closely to those detailed for the 1959 receiver but are repeated here for the benefit of those who may not have the original issue available. At the same time, there are several additional adjustments which must be made and which were not applicable to the earlier model.

The first requirement before adjustment can begin is the provision of a suitable aerial. It is best if a good outdoor aerial is available but, in the absence of this, a temporary one may be simply constructed from a length of 300 ohm feeder ribbon.

Cut a piece of ribbon approximately 7ft 6in in length and solder the two leads together at both ends. One of the wires should then be cut in the exact centre and the insulation carefully removed. The feeder ribbon to the receiver may then be soldered to the centre of this folded dipole. A quick look at the accompanying diagram will indicate the best method of mounting the antenna while making the receiver tests.

SWEEP CIRCUITS

It will be of considerable assistance if the adjustments to the sweep circuits are carried out with a station on the air. Indeed, it is imperative for the setting of the Width, Linearity and Height controls that the station be transmitting a regular test pattern. In most instances, this will require the adjustments to be carried out early in the day when most stations have test transmissions on the air.

Before switching the receiver on, the Focus, Height and Vert Linearity controls along the rear of the chassis should be set in approximately their mid position. The Contrast and DC Restorer potentiometers should be turned to the maximum anti-clockwise position. The tuner should be set to an active channel.

The horizontal oscillator coil and sine wave coil slugs may be left where they are for the present, likewise the Width and Hor. Linearity slugs. If their original settings have been altered considerably, it may be as well to check that the slugs are approximately half way into their respective coils. A more accurate adjustment may be undertaken later.

Having completed the preset adjustments, at least temporarily, the receiver may be switched on and allowed to warm up for a minute or two. The brightness control should then be advanced to the point where the screen becomes illuminated.

In some cases, it may only be necessary to rotate the horizontal and vertical hold controls in order to obtain a stationary image on the screen. Others may have to do a little more fiddling before a stationary image can be obtained.

If the picture is not locked vertically, the image on the screen will be either rolling downwards or flicking upwards, depending on the immediate setting of the hold control.

Failure to lock horizontally will produce a series of streaks running obliquely across the screen. Should neither oscillators be locking correctly, the pattern on the screen will appear extremely confused at first glance with unstable, oblique streaks flicking or rolling in the vertical direction as well.

Having seen such a complex pattern, however, it is not a difficult matter to recognise it for what it is and to take the necessary steps to correct it.

The vertical hold control should be rotated until the vertical movement stops, leaving only the oblique streaks across the screen. Rotating the horizontal hold may cause the horizonta oscillator to lock also but, should it fail to respond, a different setting of the Fine Tune control may be tried.

The reason for this is, that at this point, the oscillator may not lock correctly if the receiver is tuned too far away from the vision carrier toward the sound carrier. If the fine tune is set correctly it should ultimately be possible to change from channel to channel without losing synchronisation.

If, in spite of the foregoing, it is stil not possible to lock the horizontal oscillator, the oscillator coil will need adjustment and also possibly the sine wave coil. Set the hold control in its mid-position and then rotate the oscillator coil core until the picture locks.

You will find that screwing the oscillator core into the coil lowers the frequency, ultimately reducing the pattern on the screen to a series of broken horizontal lines. At the same time it may also be possible to hear a high-pitched whistle from the line output transformer gradually reducing in frequency.

On the other hand, screwing the core out of the coil will raise the frequency until a point is reached where the oscillator begins to "squegg" furiously, producing a rapidly pulsing pattern on the screen accompanied by squeaks from the horizontal output transformer. Between these two extremes it should be possible to locate a setting which locks the pattern on the screen, even if somewhat erratically.

If the latter condition occurs, it may be necessary to change the setting of the sine wave coil. Ideally, this should be done with the aid of a CRO connected to the junction of the sine wave coil and the horizontal oscillator coil tap. The picture should be kept locked by means of the oscillator coil slug while the sine wave coil slug is adjusted until the waveform approximates that given in the circuit diagram.

ALTERNATIVE PROCEDURE

If a CRO is not available, the following procedure, while a little more involved, may be adopted.

The horizontal hold potentiometer should be set at half its rotation and the sine wave coil should be temporarily shorted out with a piece of wire. The core of the horizontal oscillator coil is them adjusted until the picture locks.

A mark should now be placed on the nut of the core adjusting screw so that it is possible to determine the number of complete revolutions made by the slug Using this mark as a guide, observe the number of turns through which the core may be rotated before the picture breaks up.

The core is now set in the middle of this "locking range." Do not touch it or the hold control any further at this point.

Now remove the short from the sine

coil. Most likely the picture will n tear but the core in the sine wave should be adjusted until the picture ice again locked. Incidentally, do not a metal tool to adjust this core as presence of any metallic object in vicinity of the coil will affect its in- ance. A knitting needle filed to a screwdriver point is ideal.

will be noted that the sine wave also possesses a certain "locking" e, the picture tearing if the core is wed too far in or out. The core ild be set approximately two-thirds a turn back from the "too far in" it which should then make the eform fairly close to optimum.

the receiver tends to lose synch. n changing from channel to channel. core may be screwed out a little e but this should not normally be essary.

he Hold control should now be ted through its full range and, pro- ng the oscillator coil is correctly isted, it will be possible to make the ure tear at either end of the control ge. If it so happens that the picture s at one end, but not the other, the llator core may be shifted slightly to re the locking range of the control.

loser attention can now be given to Vertical Hold Control. If the verti- locking range ms to be con- trated at one of the control value of the K resistor in es with the trol may be red slightly to tre the range. nay be reduced 330K or in- ised to 620K as essary.

Having set cor- ly the locking ge of the de- tion oscillators next logical is to adjust deflection cir- output stages optimum line- y. This will in- ve a certain ount of mutual ustment be- en vertical and horizontal circuits in er to obtain the best overall results. At the same time, it will be necessary manipulate the centring magnets. se magnets are two small rings ched to the rear of the yoke assem- and operated by a pair of levers, for each ring.

Vhen the two levers are 180 degrees rt the magnetic fields cancel and ating the two rings as a group has ligible effect on the deflection of the m. Conversely, when the two levers together the magnetic fields aid each er and rotating the two together in condition causes the electron beam, consequently the picture, to move any desired direction, up, down, side- 's or obliquely.

n between these two extremes, with levers neither 180 degrees apart nor ether, different magnetic effects can obtained which will deflect the beam a lesser extent..

Once having grasped these simple ts, it should not take one long to learn how to manipulate the centring magnets to obtain the desired corrective effects and thus keep the picture centred on the screen.

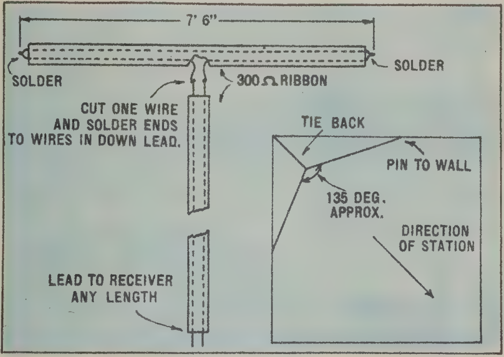
A point to notice is that, with both the levers together, one or more corners of the picture may be blacked out as the magnets are rotated. This is the so-called "neck-shadow" effect caused by the beam striking the glass envelope.

In normal circumstances it should not be necessary to have the magnets in a position where this effect becomes obvious. If such is the case, it would indicate severe non-linearity, which yet remains to be corrected.

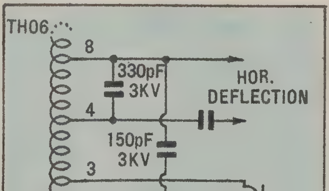
Just as a precaution, make sure that the yoke assembly is pushed hard against the glass flare and suitably clamped.

Coming now to the linearity adjustments in more detail, we suggest that the vertical circuitry be adjusted first. As mentioned before, it is essential that a test pattern be available, as the job becomes well-nigh impossible with a moving image.

The EHT voltage is affected by the brightness of the picture, and this, in turn, has an effect on the scanning characteristics of the picture. It is important, therefore, to darken the room during daylight hours so that the linearity adjustments can be made with the



If no permanent aerial installation is available for test, a simple dipole may be constructed from the dimensions given in the above diagram. In high signal strength areas such an aerial may prove adequate as a permanent arrangement.



The above circuit indicates the two additional capacitors to be added across the horizontal output transformer to prevent ringing if it should be evident at the left hand edge of the screen.

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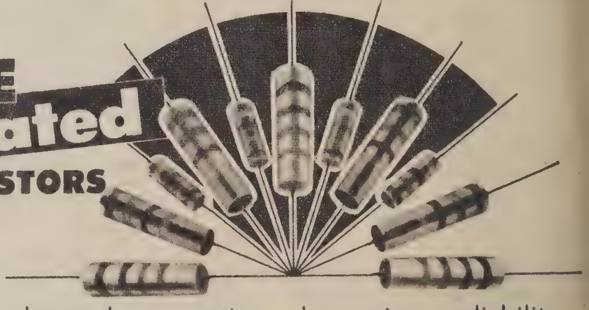

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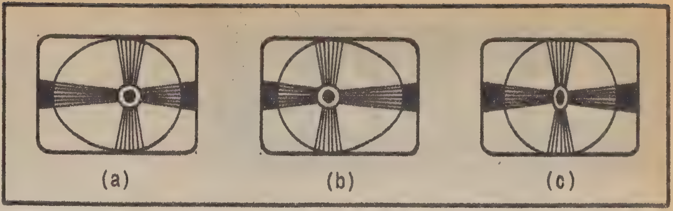


These diagrams illustrate three of the possible non-linear conditions which may occur in the horizontal deflection circuitry. The method of correction is outlined in the text.

'erage picture brightness about the me as for ordinary viewing.

Another point, possibly not always ap- eciated, is that the picture tube should the right way up on the bench or ble during the adjustments. If the be is on its side, it becomes more diffi- lt to critically assess the shape of the st pattern and, at the same time, the cture will be displaced on the screen the earth's magnetic field.

Adjust the height of the picture with e corresponding control at the rear the chassis. The picture will expand ore rapidly at the bottom than at the p but this is of no consequence and ll be corrected shortly. The control ould be set so that the edge of the pic- re is just about half an inch over the wer edge of the screen.

ICTURE COMPRESSION

Most likely the top of the picture will compressed at this point but by ad- sting the Vertical Linearity potentio- eter it will be possible to extend the cture upwards so that it just runs over e top of the screen. The centring mag- ts may now be adjusted to even the 'erall position of the picture which ould now be viewed critically from the ont.

It may be necessary to re-adjust the eight control in order to make the top d bottom of the pattern the same gen- al shape. The idea is to balance one ntrol against the other in order to ob- in the best overall vertical linearity ith the picture just spilling over the p and bottom of the screen.

Examine carefully the top edge of the ttern for signs of fold-over. If such evident, it may be necessary to change e value of the 22K resistor in the earising network between pins 5 and of the 6EM7. The value may be in- eased to 47K or more, if necessary, it this is unlikely.

Remember that the pattern will be any- ing but a perfect circle just yet as we ve made no attempt to correct the dth or improve the horizontal line- ity.

Before attempting these adjustments, wever, one further point should be entioned. In our prototype receiver, e found that we had only just sufficient dth and also that the EHT was higher an it should normally have been (which was doubtless why the width was less than we expected.)

A number of events conspired to bring about this state of affairs, components tolerance, mains fluctuations, etc. At the same time, faint ringing lines were evident at the left hand edge of the picture at high brightness levels.

After some experimenting, we decided to incorporate two additional damping components across the Horizontal Output transformer windings in such a manner that the ringing was effectively suppressed and the EHT brought down to the correct value. It was then found that the width was more than adequate for our requirements.

ADDITIONAL CAPACITORS

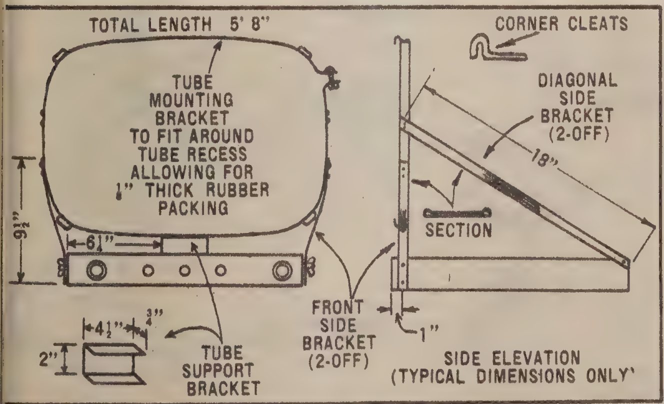
A diagram is included elsewhere in the article indicating the two additional capacitors shunted across the transformer. As suggested, it may not be necessary to include these but we feel that provision should nevertheless be made for them if required. The capacitors are mounted directly across the terminals on the EHT transformer terminal board.

Returning now to the horizontal deflection adjustments, it is necessary to remember that the horizontal scan is a composite of the current through the damper diode and the plate current of the horizontal output stage.

The linearity adjustment is consequently affected by several factors, the horizontal drive, adjustment of the linearity coil and adjustment of the width coil.

Excessive drive to the output stage will produce a sharply defined whitish line down the screen, just to the left of centre. Its edges are usually straight and its position on the screen is unaffected by adjustment of the Horizontal Hold control. In both these respects it differs from the so-called "spook" lines which are normally vague and wavery and affected by the setting of the Horizontal Hold control.

If an overdrive line is present on the screen the screw on the horizontal drive capacitor in the grid circuit of the 6DQ6 should be tightened until the line just disappears. Due to an extremely active oscillator in our prototype receiver we found it necessary to connect an additional 100 pF capacitor in parallel with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18"
SECTION
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All the necessary dimensions are given for the construction of the straps required to mount the picture tube on the chassis. Such an assembly will not normally be required if the tube is mounted in the cabinet.

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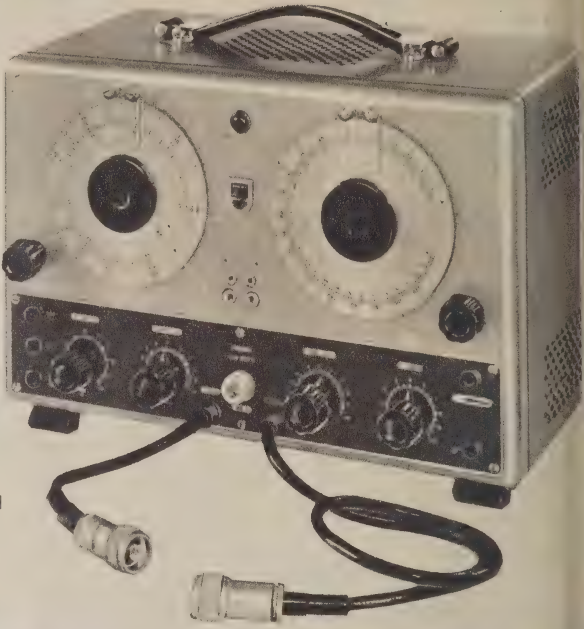

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e trimmer in order to reduce the drive a satisfactory level. This capacitor is own dotted in the schematic diagram. In some receivers it is sufficient to ave the drive capacitor at this setting, t, in others, further adjustment may be quired in order to obtain optimum earity.

As with our earlier receivers, we found at it was possible to make a reduction drive in the interests of linearity and, oviding the reduction was not exces- ve, the EHT voltage varied little.

Diagrams have been included to indi- te the basic rules which should be fol- wed when proceeding with the hori- ntal linearity adjustments.

INEARITY ADJUSTMENTS

If the left-hand side of the pattern is panded and the right-hand side com- essed as in (a), correction may be tained by decreasing drive to the out- t valve and/or bringing the slug into e width coil to increase its inductance. (It is important to note that in the idth and linearity coils the slug moves to the coil to increase the inductance the brass adjusting screw is rotated ti-clockwise.)

If, conversely, the left-hand side of e pattern is compressed and the right- nd side expanded, as in (b), the drive ould be increased and/or the induc- nce of the width coil reduced.

The third condition, indicated at (c), ows the two sides reasonably balanced t the centre of the pattern obviously mpressed. In general, such distortions the centre of the pattern require ad- stment of the linearity coil.

Adjustment of this coil, however, does ve an effect on the width of the pic- re. It may be necessary to select a tting which is a compromise, in which asonable overall width is obtained ithout obvious aberration around the ntre of the pattern.

EGULAR TEST PATTERN

Having thus adjusted the horizontal earity, it may be necessary to modify ghtly the height and vertical linearity ntrols to produce a completely regular rcle in the test pattern. As mentioned rlier, these adjustments should be made ith the screen set at normal night-time ewing brightness.

The focus control may now be rotated til the position is found which gives e best focus in the centre of the pic- re. With electrostatically focused tubes e focus control will have only a small fect and it may be necessary to inspect e pattern closely to observe the correct tting.

The DC restorer control is set in the llowing manner. With the potentio- eter in its maximum anti-clockwise sition, set the brightness and contrast ntrols to produce a normal picture on e screen. The ambient light conditions e the same as specified for the earlier ljustments.

The set should now be switched to a ank channel and the DC restorer con- ol advanced until the screen just blacks it. Switching back to the active chan- l, the contrast control may need a rther adjustment, but it should not be fficult to reach the condition where timum picture contrast coincides with complete blackout on the inactive annels.

This completes the settings of the pic- re quality controls and, if desired, a ot of wax or varnish may be applied to the various adjustment screws and shafts to prevent accidental movement in the future. It is not advisable, however, to seal the adjustments so thoroughly that it almost becomes a major wrecking job if, at a later date, readjustments become necessary.

Alignment procedure was dealt with briefly in the first article and it was assumed that the majority of constructors would leave the final alignment to someone competent to do the job and who possessed the necessary equipment.

On the other hand, there may be those who possess, or at least have access to, a sweep and marker generator and a CRO. For the benefit of this group, we would suggest that they examine carefully the alignment details given in the March, 1961, issue describing the use of the sweep generator. All the necessary information is given and will be applicable to other types of generator as well as our own.

We pass on now to some of the mechanical aspects of mounting the receiver into a suitable cabinet. Here, if nowhere else, the individual constructor can be fairly safely left to his own devices.

As mentioned earlier, common practice at the present time dictates that the picture tube be mounted in the cabinet, separate from the chassis except for the connecting cables.

TUBE SUPPORT

If this is the procedure adopted, it will be necessary to fabricate some means of support for the tube. The 23AVP4 tube specified for this receiver has a heavy glass projection at each corner of the screen and it would be logical to utilise some form of wooden block or beading behind these to hold the tube firmly against the front of the cabinet.

It must be decided first of all, however, whether a mask is to be used with the tube or whether the bonded face plate is going to be allowed to project through the front of the cabinet. If the latter approach is decided upon, the cutout in the front of the cabinet will provide some measure of support for the face of the tube. If a mask is used, additional blocks will be required to support the front of the tube off the shelf of the cabinet.

Whichever method is adopted, it is imperative that the whole weight of the tube be supported at the front panel. In no circumstances should brackets or other devices be used to support the tube by the neck section.

CHASSIS MOUNTING

The alternative suggestion and the one we adopted mainly for ease of manipulation around the laboratory, is to mount the tube on the chassis by means of suitable straps and brackets. This method is clearly indicated in the photographs of the completed receiver.

The metalwork used in the making of both strap and brackets is aluminium moulding of the type normally used for edging tables, benches, etc. It is available in 6 or 7 foot lengths from most large department or hardware stores. The relevant dimensions are given in a diagram for the benefit of those who may like to use this method. It has the advantage of permitting the chassis to be removed for test without having

(Continued on Page 109)

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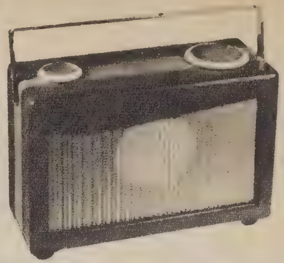

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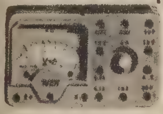

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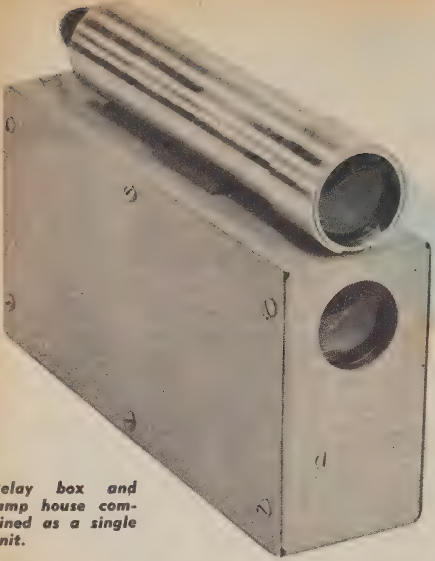

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By John Davidson

SEVERAL years ago, in June 1953 to be exact, we described a Photo-cell Relay Unit using a gas filled photo-cell and thyratron amplifier. We suggested that its main application might be to guard shop doorways, etc., and in this application it appears to have been extremely popular.

TRANSISTOR INFLUENCE

With the rapid progress of transistors and photo-diodes we can now describe a similar unit in considerably simplified form, which should be just as popular. Indeed, while the method may have changed, the applications and advantages of such a device are much the same as ever, and we can hardly do better than repeat some of the remarks we made about our original unit.

Although there are many ways in which such a unit may be used, the one most likely to appeal to the average reader is that of the "shop minder." In this application a beam of light is focused, either directly or zig-zag via mirrors, across the shop doorway and finally allowed to fall on the light sensitive cell. The associated circuitry is so arranged that, while ever the light is present, a pair of relay contacts are kept in the open circuit position.

However, as soon as the light is removed from the sensitive area, even for a fraction of a second, the relay is energised, the contacts closed and any kind of alarm to which the contacts may be connected is operated. This means that it is virtually impossible for anyone to enter the shop without operating the unit, even if they know that the system is in operation. In most cases they need not know.

A system such as this will appeal particularly to the one-man service shop, where the proprietor will normally spend most of his time in the service department at the rear of the premises. Even when the working position is most favourably placed to watch the shop (and this is not always possible) it is extremely difficult to concentrate on one's job and still effectively "keep an eye on the shop."

Customers dislike being kept waiting and impatient types are just as likely to walk out if not acknowledged immediately.

PILFERING

There is also the very real possibility that some "light fingered" members of the community, once they discover that they can enter the shop without being noticed, will slip a small but valuable appliance under their arm and walk out.

In these circumstances a photo-electric "shop minder" can take over the entire job of "watching" the counter. The proprietor, relieved of this irritating responsibility, can concentrate on his work secure in the knowledge that no one can enter the shop without announcing their presence.

Almost any business will benefit from such an installation, particularly where the staff must divide their time betwe a workshop and the sales section. In petrol station it will provide immedia warning that a customer has driven to the pumps, even though the staff out of sight in a grease pit or the rear the shop.

One of the features of these syster is that it is almost impossible for "sma customers to "beat" them. The sa cannot be said for mechanical syste involving floor contacts, because peo very soon learn where to step in ord to avoid them. Furthermore, floor co tacts are easily affected by dirt ar when they do give trouble, it is usua necessary to pull half the floor up service them.

Another possible application is t opening of garage doors by remote co trol, either by breaking a light bea or by using the car's own headlight bea These are but a few of the possible a plications for a unit of the type we a about to describe.

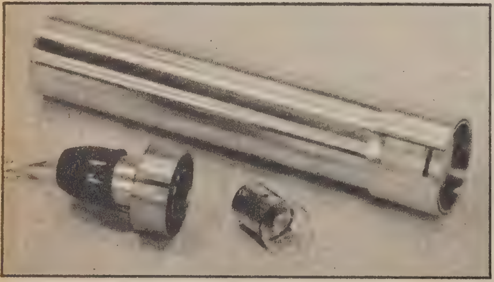
So much, then, for what such a u will do. Now for a few points abo how it works.

EFFECT OF LIGHT

During the early development of sen conductors and transistors, it was fou that variation in the amount of lig striking the semiconductors produc changes similar to those caused by temp ture variations. These findings have be put to use in the form of three differe types of photo-sensitive devices, name photo-diodes, photo-transistors a photo- conductive cells.

The photo-diode is basically a sin PN junction enclosed in a small gl sealed tube, one end of which may ta the form of a lens to help concentra the light rays on to the junction. If th diode is biased in the reverse directi and in the absence of light, only a ve small current will flow. This is call the "dark current" and will amount about 10 microamps.

However, as soon as we allow lig to reach the junction, the current fl will increase markedly, usually by factor of 100 times or more. This ord



☆

Details of the lamp house, showing the lens mount assembly and the lamp socket mounted on the sliding ring. A car type tail light lamp will suffice in most applications.

ange is quite high and, in favourable mstances, can be used to operate a tive relay directly.

ne photo-transistor is effectively a tion transistor with a light sensitive region. It has the advantage that it ot only light sensitive but will also lify the current change into the col- r circuit.

hoto-conductive cells consist essen- y of a thin film of semiconductor erial in which the conductivity ges with the intensity of the light ng upon it. They generally employ iconductor materials such as nium sulphide, indium antimonide, sulphide and a number of others, of which have been chosen for their vidual properties.

f the three devices mentioned above, photo-diode was the first to be made lable to us with suggested circuits its use. The theory of its operation in cal applications is given below.

MPLEST CIRCUIT

he simplest possible arrangement is vn in Fig. 1, where the photo- le, a sensitive relay, and a small ery are connected in series. In spite its simplicity, this is a perfectly tical circuit for many applications. ough not as sensitive as the more orate arrangements, it will work quite bly over distances up to six feet, g the optical system to be described r. For a single beam across a door- it should be perfectly adequate.

relay having an operating current of A is recommended and one having oil resistance of 5000 ohms should . Improved sensitivity can be ob- ed by reducing the spring tension on armature and also the air-gap be- en the armature and the relay pole- .

battery could be used to supply the ll amount of current required but, door minding, etc., where the beam on the diode continually the relay t remain closed continually and this make battery operation inconveni- or uneconomic. A simple mains- rated power supply, suitable for this lication, will be described later.

or more exacting situations, where ter sensitivity is required, the next cal step is the addition of an ampli- g stage, using a single transistor. Figs. nd 3 illustrate typical arrangements. h the transistor connected in the mon emitter configuration, the di- is connected so as to form part of forward bias divider network to the e of the transistor.

f, as in Fig. 2, the photo-diode (in es with a current limiting resistor) ns that part of the bias network be- en the base and negative supply then, the dark condition there will be vir- lly no forward bias. As a result, lector current will be at a minimum l far below that required to operate relay.

With the application of light to the to-diode, the latter becomes conduc- , increasing the forward bias on the nsistor and with it, the transistor col- or current. If the light is sufficient, latter will be high enough to oper- the relay.

Alternatively, if the photo-diode is nected in the base-emitter portion of bias network (Fig. 3) the reverse ion will occur. During the dark con- on maximum forward bias will be lied to the transistor, causing high lector current and relay operation.

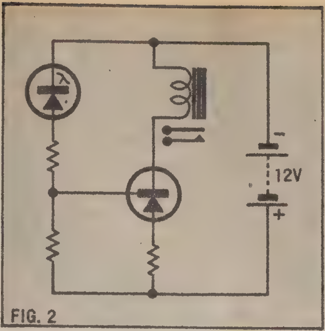


FIG. 2

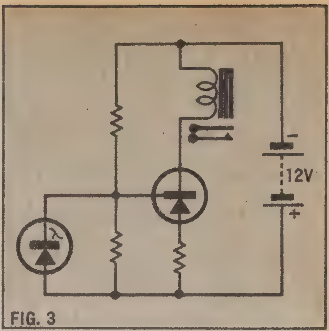


FIG. 3

Two versions of a photo-diode/amplifier combination. Fig. 2 is for use where an increase in light is to close a relay, and Fig. 3 where a decrease in light is to close it. In both cases the photo-diode conductivity is used to vary the forward bias through the transistor.

When sufficient light intensity is beamed on to the photo-diode there will be minimum forward bias, little collector current and no relay action.

These two opposite configurations have specific advantages in different applications, depending on whether light is likely to be present for the greater period of time, or whether darkness is the predominant condition. The "shop minder" set-up is typical of the first condition, while a garage door to be opened by a headlight beam typifies the second one.

In either case, of course, it is quite possible to reverse the operating sense of the system by substituting "normally closed" relay contacts for "normally open" types, or vice versa. However, particularly where battery operation is considered, it is obviously advantageous to maintain the relay in the "non-operate" condition for the greater part of the time.

In regard to power supplies, we were forced to debate the relative merits of battery and mains operation. While, at first glance, the transistor circuit appears to be a "natural" for battery operation, it must be remembered that power also must be supplied to operate the energising lamp.

In our previous version the light source was a car tail lamp operated from the mains via a transformer. This still seemed the best proposition and an arrangement using two separate supplies seemed, if anything, a disadvantage, particularly with regard to size. A possible exception is where the relay unit is required to function in some position remote from the mains supply and where the running of the necessary wires is inconvenient.

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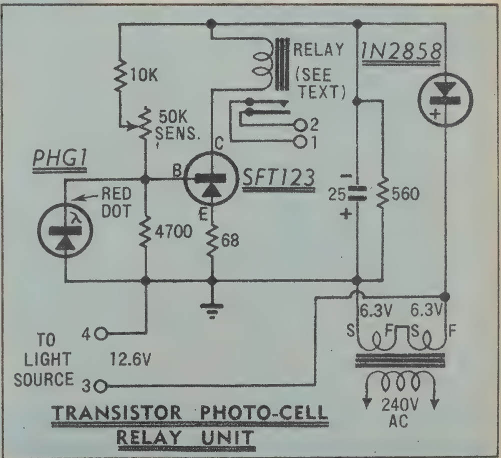

This is the practical circuit derived from Fig. 3. A battery may be substituted for the power supply, where this is more convenient. Standing current is only a few microamps.

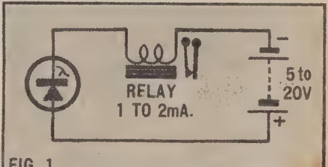

FIG. 1

A simple but perfectly practical circuit for short distances. If preferred, a small power supply may be used in place of the battery.

For this reason we decided to operate the whole unit from the mains, using the one transformer to supply both the light source and 12 volts DC for the transistor circuit. The transformer was one of the small filament type, having two secondary windings of 6.3 volts at one amp which, when connected in series and in correct phase, give 12.6 volts at one amp.

A silicon diode is used in a simple half wave rectifier circuit, the 1N2858 being one of the cheaper types, but others having higher inverse voltage ratings such as 1N1763 could also be used. The circuit as shown should deliver about 12 volts.

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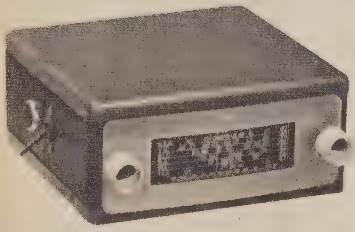

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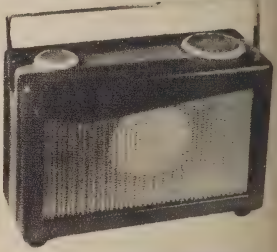

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R.C.S.

R.C.S. Radio Pty. Ltd., 651 Forest Rd., Bexley, N.S.W. LW3491-5385 te the simple circuit in Fig. 1 from wer supply rather than batteries, this circuit may be modified to de- about 18 volts. All that is neces- is to remove the 560 ohm bleed re- and increase the filter capacitor ay, 100 mfd.

e photo-diode and transistor used Ducon types, PHG1 and SFT123 ctively. The relay we used was an sposals type, having a coil resist- of 1500 ohms, although relays of and 5,000 ohms also performed actorily. The contact arrangement e relay may be selected to suit in- ual requirements, but for our pur- a single pair, normally open, is all is required.

ICAL SYSTEMS

r those applications where there is ally a higher level of light available ay be possible to use the unit with- urther refinements. In most cases, ver, best results will be obtained if some kind of optical system is at either the light source, the -diode, or both.

e system we are about to describe two lenses, one at the light source one in front of the photo-diode. It des a high order of sensitivity, be- apable of operating over a distance cess of 30 feet, using only a 6 watt ail lamp in a bright, naturally light- ffice. Even a humble torch globe. at 2.2 volts, 250 mA, will operate a distance of six feet.

greater distances need to be cover- would be a simple matter to use ger lamp, say 25 or 35 watts, oper- from a separate power transformer, or a more efficient optical system.

e function of the lens in front of lamp is to concentrate the light into a near parallel beam, produc- small blob of light at the distant . If only one lens is to be used, will be the best place to locate it.

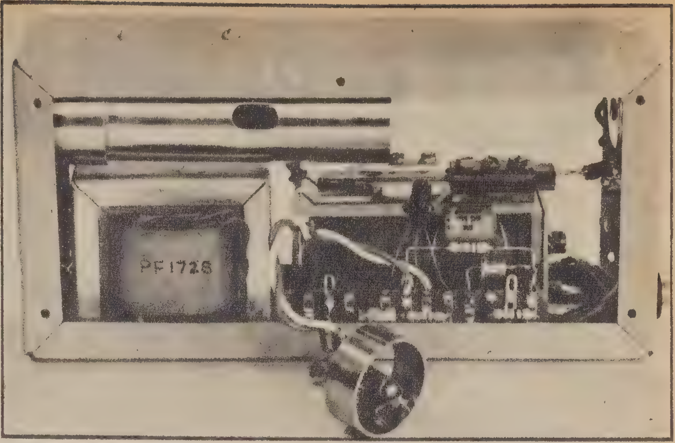
e second lens is desirable mainly use the photo-diode is so small phy- y. The blob of light produced by first lens will be much larger than sensitive area and so much of it is ed. However, if we use a second to focus the rays back to a point, vill increase the sensitivity very sub- ially.

NS SIZE

eally, the second lens should be enough to accommodate the entire thus using all the available light. ractice this may call for a large lens be justified only in special circum- es. We used a pair of 1¼in diame- ens supplied by E. Esdaile and Sons, ter Street, Sydney. The lamp lens a focal length of 5in and the cell 3in. The values are not particularly al, and lenses salvaged from dispo- equipment, etc., may be quite suit-

e actual construction of the unit is straightforward and reference to drawings and the photographs should ide all the information necessary to le the original to be duplicated. ever, there are a few points worthy articular mention.

e box is constructed from a strip 8-gauge aluminium measuring 22¼ es by 3 inches overall. After mark- out but prior to cutting and folding, ries of ⅛in holes is drilled at the ts which will eventually become the



Most of the components can be clearly seen in this picture of the complete unit. The sensitivity pot is just visible in the top right hand corner and part of the screw type terminal strip just below it. Note the photo-diode in the foreground.

corners of the box. Vee-slots are cut into these holes from the sides and the folds made. Two side pieces, measuring 7¼ inches by 3¼ inches, are made from a lighter gauge aluminium.

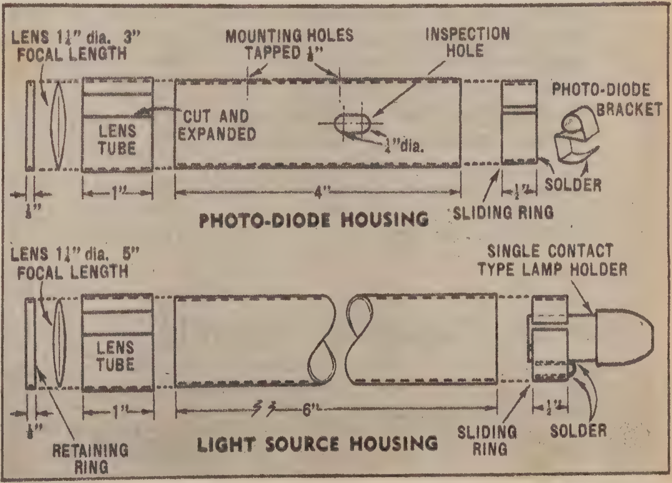
Two pairs of terminals are required to connect the external circuits to the relay contacts and the 12.6 volt AC supply for the lamp house. A four terminal strip, using screw terminals as used on TV sets, is mounted at the rear of the box. The mains supply lead, entering also at the rear, is terminated on a small two terminal insulated connector strip screwed to the front of the box. Both the transformer and relay mount on the bottom of the box but the position of this latter item and the type of bracket required will depend upon its type.

The few internal connections are accommodated on two tag strips, a four terminal type near the transformer and an eight terminal type alongside it. The four terminal unit is used to terminate the two 6.3 volt transformer windings. The eight terminal unit supports the transistor and associated components.

Details of the photo-diode mounting and light source can be obtained from the drawings and photographs. The overall length of the brass tubes will be dependant upon the focal length of the lenses obtained and in our case the photo-diode mounting tube was cut to four inches, although space is available within the box to accommodate a much longer focal length lens.

The ideal way to mount the lenses is by supporting them inside the tube with retaining rings cut from short lengths of tube. However, we had difficulty in obtaining 1¼in inside diameter tube, so we employed 1¼in outside diameter material in the manner shown. A short lens tube is made by cutting and expanding a section of 1¼in tube, while a narrow section of uncut tube is used as a retainer ring.

Both the photo-diode and the lamp are supported on sections of tube cut and compressed to form a sliding fit inside the main tube. In the case of the cell support, a long metal screw serves as a handle to facilitate adjustment. The photo-diode, supported first in a piece of



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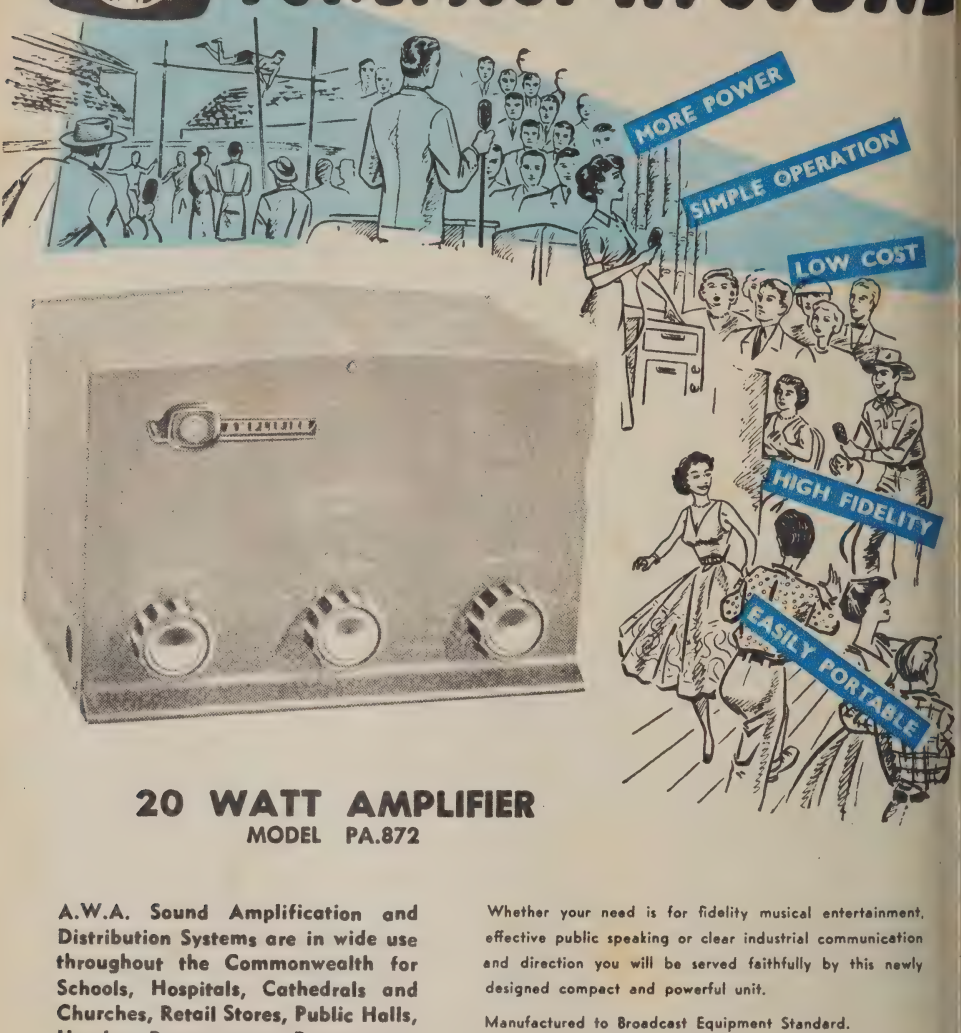

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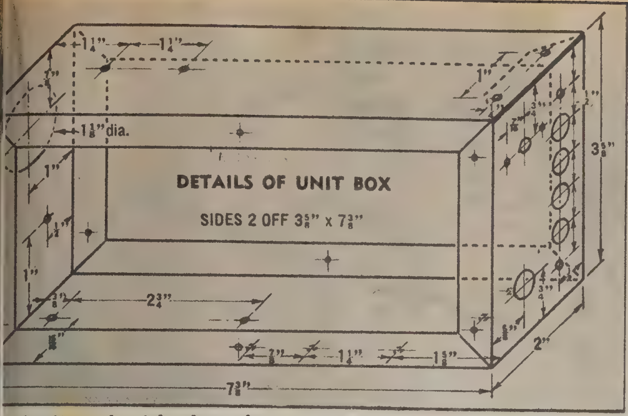

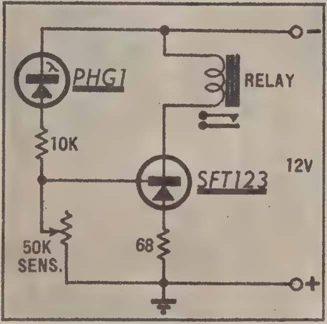

› circuit on the right shows the ‹v changes necessary where it required that the relay close with an increase in light.

: tubing, is mounted centrally with imple bracket shown.

: cell tube is provided with tapped to permit mounting to the top of :ase, and an inspection hole to :ate setting the diode to the focal

USTMENT

al adjustment of the unit is best in the situation it is to finally y, but preliminary checks can be with a temporary set-up in the shop. Separate the two units by required distance and adjust the holder in the lamp house to pro- the most concentrated spot of light he photo-diode lens. Unless the ting distance is changed, all other tments may be made at the relay

is end of the optical system should ljusted until the most concentrated of light is reaching the photo- . Focus is achieved by sliding the support back and forth, and posit- f the spot by slight changes in the of the complete box. The first adjustment is made by checking ly through the inspection hole.

: more precise adjustment, a milli- :ter should be connected in the tor circuit of the transistor and the l system adjusted for the lowest ble standby current. Once this is ved the optical adjustments may be led as complete.

SITIVITY ADJUSTMENT

: sensitivity control should now be :ed. This forms part of the forward circuit and provides adjustment to ndividual relay and transistor char- stics. It should be adjusted so as duce minimum standby current, or point where no further decrease in y current occurs.

a typical case, with a properly ed optical system, this will be d the 20 microamp mark, increas- several milliamps when the light noved. This latter figure will vary what according to the relay resist- being 6 mA in our case, using a ohm relay.

ally, the modified circuit on this shows the changes necessary where the system is required to close a relay with an increase in light. With this arrangement the sensitivity control should be adjusted for the best combination of minimum standing current and adequate operate current.

For low light levels it may be necessary to tolerate a standing current of .5 mA or more in order to achieve adequate sensitivity. More usually, with reasonable light levels, a figure between 10 and 12 microamps can be achieved, rising to several milliamps when light is applied.

PARTS LIST

1 Metal box (see drawing).
1 Length of brass tubing approx. 14in (see drawing).
1 Filament Transformer two windings of 6.3V 1A. or one 12V winding.
1 Silicon diode type 1N2858.
1 Photo-diode type PHG1.
1 Transistor type SFT123.
1 Relay 500 to 5000 ohm coil, 1 pair normally open contacts.
1 25 mfd 25 VW electrolytic capacitor.
1 50K tab pot.
1 10K ½W.
1 4700 ohm ½W.
1 68 ohm ½W.
1 560 ohm ½W.
1 12 Volt 6 Watt tail light lamp.
1 Lamp holder to suit.
1 Lens 1¼ dia. 5 inch focal length.
1 Lens 1¼ inch dia. 3 inch focal length.
1 2 terminal insulated connector strip.
1 4 screw terminal strip.
Tagstrips.
1 4-tag, 1 8-tag.
1 ⅜ inch grommet, power flex, hookup wire, nuts and bolts, scrap metal for brackets, etc.

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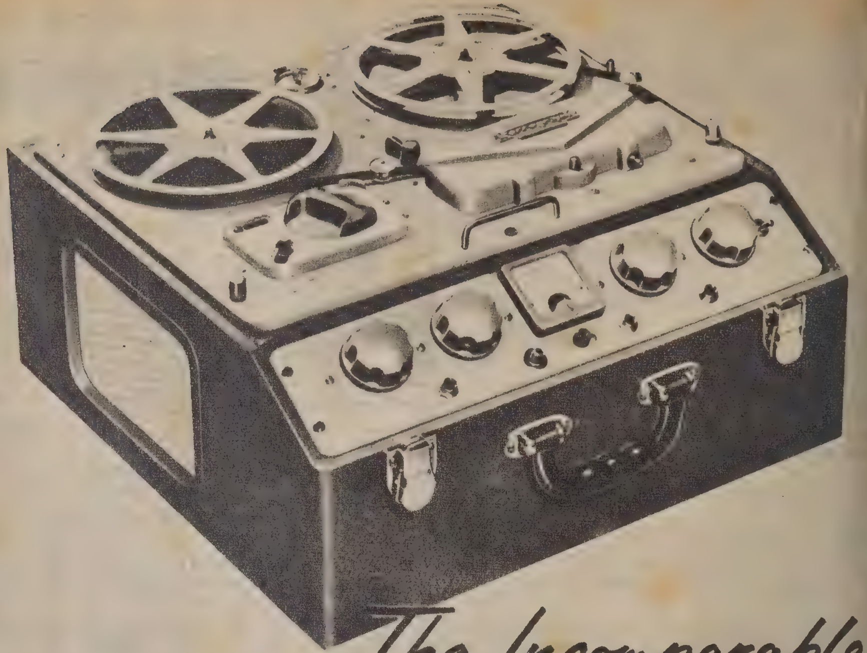

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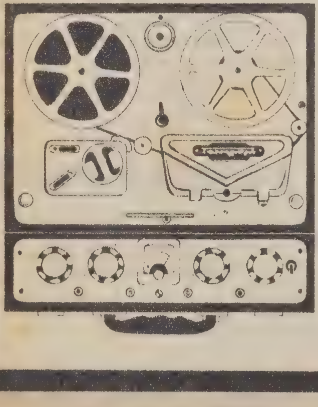

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so, not having had suffi-
nt experience to make him
naturally cautious.**

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and Television College. Particu-
in the radio classes, hardly a lesson
by without some student learning
late—that a meter should be set
e appropriate range before measur-
T voltages.

d, since meter repairs cost time (or
y) it was a very real problem. It
eriously suggested that VTVM type
ments should be substituted, but
suffered the disadvantage of not
ng typical loading problems which
dent must learn to appreciate.

ain, it was suggested that a special
M be employed, in which the load-
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same instruments are still in use
out one case of a damaged pointer
g been reported. The movements
in fact, in virtually new condition.

ce it would be impossible for these
rs to be used for that length of
without incurring regular severe
oads, it provides an excellent indi-
n of just how much punishment
an instrument will take.

oof of just how severe such over-
can be was provided recently when
of the instruments was found to
an inoperative ohm meter circuit.
eck revealed a badly charred series
or which—very obviously—was the
n of an attempted HT measurement.
nally this would mean a badly
ged meter, but the diodes had done
job well; there was not the slightest
estion of meter damage in any form.
is hard to imagine a tougher test
any meter than continuous use in
environment, but this circuit has
through with flying colours.

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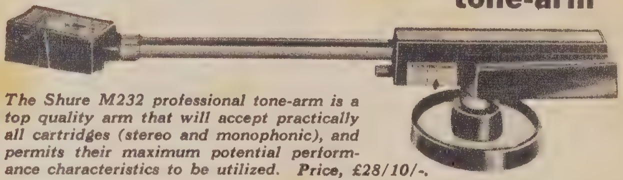

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Practical Aspects Of The

TUNNEL DIODE

Has your technical appetite been whetted by the many articles and stories about that fascinating semiconductor device, the tunnel diode? If so, read on, for this article should prove interesting. While demonstrating in a practical fashion the many jobs to which the device may be applied, it also attempts to give a truthful picture of its capabilities, by pointing out some sobering features.

By Jamieson Rowe

AS you may recall, we presented a theory article on the tunnel diode in February, of this year. At this time, we were not able to carry out practical tests on the units, due to pressure of other work and to technical difficulties with the specimens then available.

Recently, however, the Semiconductor Division of Standard Telephones and Cables Pty. Ltd., released a range of six types of tunnel diode designated the "JK" series. They very kindly presented us with three of these, suggesting that projects featuring them would be of considerable interest to "R., TV and H." readers. We agreed, and set about putting the units into operation, aided by data from S.T.C. and the theory books.

Right from the outset, an important point regarding the tunnel diode became apparent, namely that, as far as the home constructor is concerned, it must still be regarded as a developmental device. Commercially, the tunnel diode is undoubtedly proving most practical, even to a revolutionary extent, but a number of reasons exist to weigh against its widespread use at present. Before we go any further, it would be wise to examine these reasons.

Firstly, there is the problem of initial cost. At present, with the commercial applications of the diode only partly realised, the market is limited. Accordingly, the units are being manufactured in small batches only and the cost per unit is relatively high. Also, the units are only being made in England and America, which means that import costs add still further to the local figure.

Although the cost-demand system is obviously something of a vicious circle, there is every reason to expect t things will improve, and that the pr will drop considerably in the near futu (Present prices range from 60/ to ab 120/ trade, plus tax). The main rea for such optimism is the fact that t nel diodes are fundamentally very e to manufacture — easier, in fact, th most transistors.

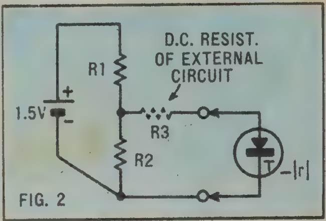
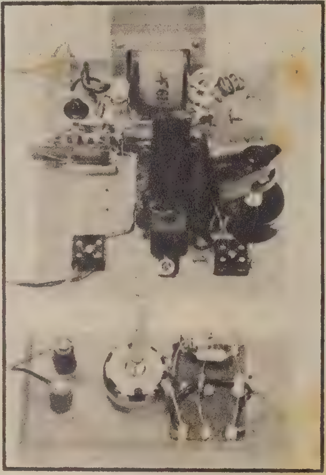


FIG. 2



The photograph above shows the curve plotter and power supply. The large breadboard is used for the power supply and curve plotter sweep circuitry, with the actual diode mounting jig on a separate block. Although the power supply is very handy for many tunnel diode experiments, it may be omitted and dry cells used for those involving low negative conductance diodes. High conductance types may even prove unsuitable for this supply, however, requiring an accumulator.

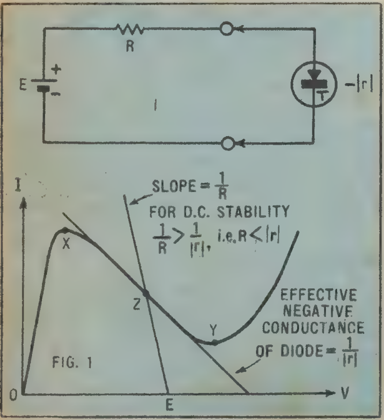

R
E
+
-
I
-|r|
I
SLOPE = $\frac{1}{R}$
FOR D.C. STABILITY
$\frac{1}{R} > \frac{1}{|r|}$, i.e. $R < |r|$
X
Z
Y
EFFECTIVE NEGATIVE CONDUCTANCE OF DIODE = $\frac{1}{|r|}$
0
E
V

FIG. 1

The diagrams above and to the left illustrate the text in regard to tunnel diode biasing problems. Low bias levels and source resistance prove embarrassing in practice.

On the technical side of things, h ever, there is a problem which is so easily solved — a feature of curr tunnel diodes which considerably tricts their application in many fiel The problem concerns power supply pedance requirements, so we had bet refresh our minds on this aspect of theory.

The problem arises in all those ap cations where the diode is operated the negative resistance region of characteristic — which means whene it is required to amplify or to oscill Examination of figure 1 will help make the problem clear.

DIODE CHARACTERISTIC

Here we see the now-familiar char teristic of the device, and a small cuit used to represent D.C. conditions a simple amplifier or oscillator circu

The battery E, represents the sup voltage, and the resistor R, represe the TOTAL positive circuit resistanc lumped as an equivalent series or "T venin" resistance.

For use as an amplifier or oscillat the diode must be biased to operate the negative resistance section of characteristic, X-Y. The point Z be considered as the selected operat point.

From the theory, the only way which we can bias the diode stably this point is to ensure that the loadl (slope I./R.) cuts the characteristic THIS POINT ONLY. For this to h pen, R must be LESS than the di negative resistance r. Thus the sum power supply source resistance and ternal circuit resistance (plus diode p tive resistance, strictly) must always less than r.

At present, this means that the t circuit resistance must be less than ohms (low power types) or 10 oh (high power types)! There is more come, however.

With all present diodes, the sup voltage E is in the range of 100- millivolts. This means that the dio cannot be supplied directly from a b tery, but must be fed via a volt divided, as in Figure 2.

Here R1 and R2 are the divider sistors, and R3 represents the DC sistance of the external circuit. satisfy the stability criterion, R3 p

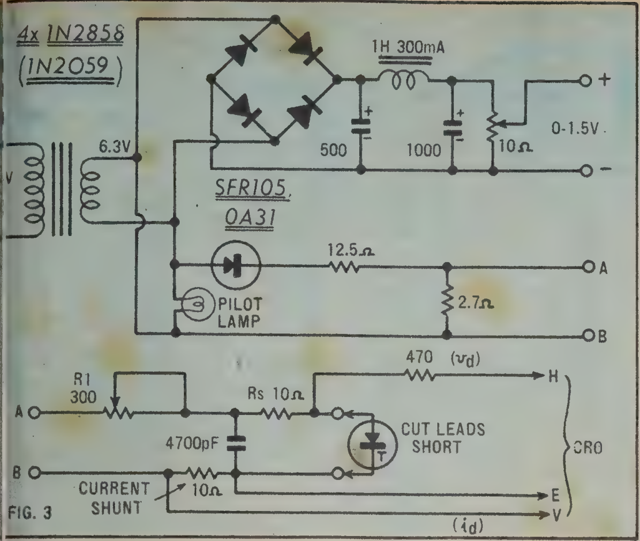


FIG. 3

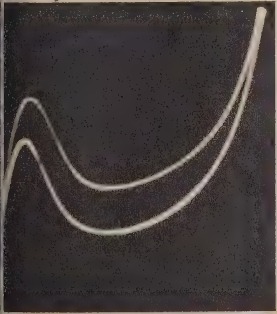
and R1 in parallel) must be less
r.

many oscillator circuits and most
ifier circuits, R3 must be kept as
as possible for efficient operation
iat it becomes a considerable pro-
on of the value of r. This means
the resistors in the divider must
iade very low in value. Thus the
ry drain rises, and it is not un-
non for divider current to be 30 or
imes that used by the diode.

viously, this ratio of battery drain
iode consumption means that the
it is very inefficient indeed in terms
verall current drain. Battery life
be quite short, even for low-power
es.

specialised commercial equipment,
inefficiency can often be tolerated,
device still being preferred for its
licity, temperature stability, etc. But
home-constructed receivers, trans-
rs, etc., it is most important, and
dices application of the tunnel diode
any such fields.

rious though this problem is, there
t a glimmer of hope. There ap-
to be no serious reasons why tun-
liodes will not be developed having
ating points in the 1 to 2-volt region.
id when this comes about, current-
uming dividers will not be requir-
and the overall efficiency will rise
iderably.

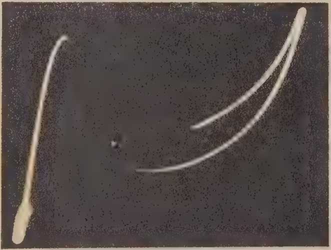


hotograph 1: A typical tunnel ode curve as shown on the CRO screen.

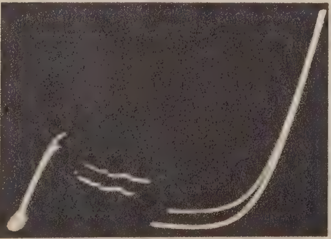
Alternatively, batteries having low source resistance and terminal voltages of 200-400 millivolts may be practicable, which would also improve matters a great deal. One way or another, batteries and tunnel diodes must come to a suitable working compromise, if their full benefits are to be realised.

Considering all these points, it is rather impractical at present for us to describe ambitious constructional projects utilising the tunnel diode. However, even at present, some interesting devices may be constructed using it, as the photographs on these pages show.

This then is the explanation of the present article—the devices shown and discussed are not intended for construction (except perhaps by readers who, like ourselves, are inveterate "fiddlers"), but merely to illustrate in a practical



Photograph 2: Switching characteristic produced by large circuit resistance.



Photograph 3: Diode characteristic with HF oscillations in evidence.

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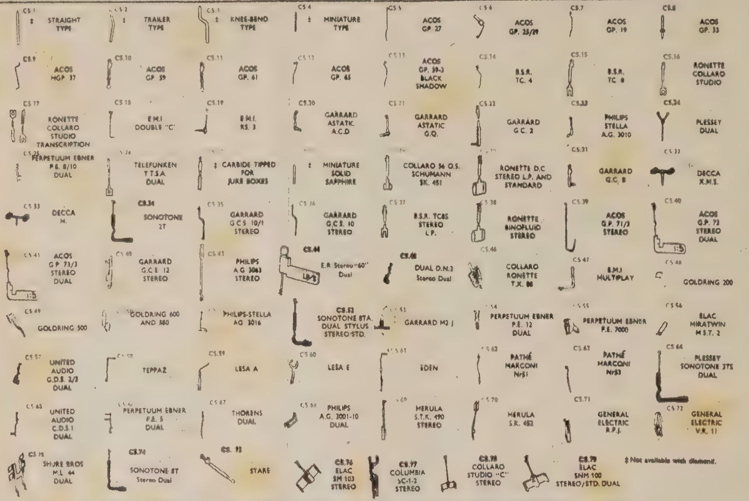
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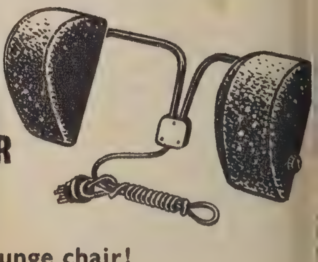

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possible applications of the tunnel . We present the article in the that readers will find the practical ts of the device as interesting as ave found them!

rhaps the first practical device to ss would be the one which we first tructed. This is a combination r supply and diode curve tracing and its circuit is shown in figure 3.

e power supply section is quite htforward, as you can see. It is ly a bridge rectifier circuit using 1N2858 silicon diodes, followed by filter section using a small filter e and two high value electrolytic itors. Finally, there is a 10 ohm tiometer providing an output, vari- from zero to 1.5 volts.

e curve tracing section is divided two parts—a sweep unit and a test The sweep unit is built on a small lboard layout with the power supply ng the power transformer, while the jig connects to it via a cable.

e curve tracing sweep unit consists half-wave rectifier circuit, with an 105 (or OA31) germanium diode ing into a resistive load. The out- which appears across the 2.7 ohm tor, consists of unidirectional pulses sponding to the positive half-cycles e AC input.

OWN ON CRO

is waveform is applied to the diode r test in the jig, and signals pro- onal to diode voltage and current ed to the horizontal and vertical am- rs of a CRO. Since the applied ge sweeps over the complete useful acteristic of the diode, the spot on CRO screen traces out the current- ge characteristic of the diode. (See photographs reproduced on these s.)

e resistor R1 on the tracing jig is to adjust the main component of ly source resistance. It is normally to zero) so that this is below the e of r for the e under test, may be adjust- for a value er than r if ching action is red.

esistor Rs is to supply the mum value of ce resistance wable for HF ility. Its leads those of the diode, as well as those of the current shunt and the bypass capacitor, are cut quite short to reduce lead inductance. If resistor Rs is not included, or the leads are not cut short, it will be found very difficult to prevent HF self-oscillations of the diode from marring the characteristic.

TWO CIRCUITS

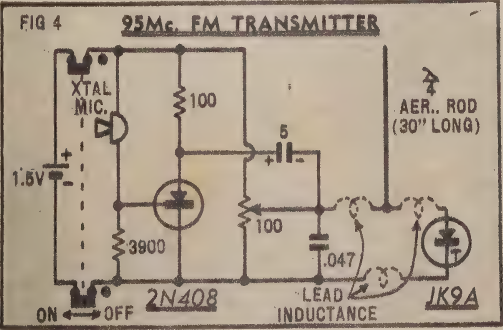
Note that there are effectively two circuits on the test jig—one comprising the diode, Rs and lead inductance, and the other comprising the diode, R1, Rs, the current shunt and the supply. The first is the effective circuit at HF, and for stability Rs must introduce enough resistance to prevent parasitic oscillations—the higher lead inductance, the larger the value of Rs. The second circuit is the DC equivalent circuit, and for stability the positive resistance must be less than r.

With the tracer constants correctly adjusted, the characteristic of the diode under test will appear on the CRO screen (see photograph 1). If R1 is set to a value producing a positive resistance in the circuit greater than r, switching will be in evidence (photo 2) as the diode will not traverse its negative resistance section. On the other hand, too small a value of Rs or long diode leads will show up as HF oscillations in the trace (photo 3).

Note that the 470 ohm CRO isolating resistor picking up the voltage signal from the diode goes straight to the diode. Although this procedure involves a small risk of upsetting the HF stability, it must be done if the CRO is to indicate an accurate voltage signal of the diode. If it were placed on the other side of Rs, for instance, it would indicate the (diode plus Rs) voltage. Note also that the current shunt resistor should be kept as small as the CRO sensitivity will allow, so that R1 and Rs will represent DC and HF circuit resistances as accurately as possible.

Incidentally, you will note that the CRO pattern photographs show a double curve, indicating that conditions are different for ascending and descending voltages. This phenomenon is due to local heating effects in the diode junction. Strictly, neither of the curves shown on the screen is the "actual" characteristic, which would be somewhere between the two.

FIG 4



The next practical circuit which we built up is a small battery-operated FM transmitter which may be seen in the photograph. The circuit is shown in Figure 4.

Basically, the unit consists of a simple oscillator comprising the JK9A tunnel

The little FM transmitter is built into a small plastic utility box. A terminal at the top facilitates connection of the rod aerial, and a small slider switch controls operation. The circuit shown above emphasises the simplicity of the design, which uses a handful of components.

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1 valve broadband, all Channels 1-4, gain 20 db, noise level 6db, max. output 0.7 V.
1 valve single Channel (any Frequency between 5-11) gain 21 db noise level 6 db, max. output 1.4 V.
1 valve broadband ampl. covering all Channels 5-11 gain 17db, noise level 7 db, max. output 0.7 V.
2 valve single Channel (any freq. betw. 1-4) gain 44 db noise level 4 db, max. output 0.7 V.
2 valve covering all Channels betw. 1-4, gain 34db, noise level 6db, max. output 0.7 V.
2 valve single Channel (any Channel between 5-11) gain 42 db, noise level 5 db, max. output 1.4 V.
2 valve broadband covering all Channels between 5-11, gain 30 db, noise level. 7db, max. output 0.7 V.

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ZEPHYR PRODUCTS PTY. LTD.

58 High Street Glen Iris, Vic.

diode and the inductance of its Bias voltage is supplied to the from a 100 ohm potentiometer the 1.5 volt dry cell and is by-p for RF with a 0.047 mfd capa A simple quarter-wave rod aerial (c approximately 30in for 95 Mc/s) s as a radiator.

By modulating the bias voltage o tunnel diode, the resonant frequen the RF oscillator is altered and modulation results. Bias voltage erns both the diode negative resis and the junction capacitance so

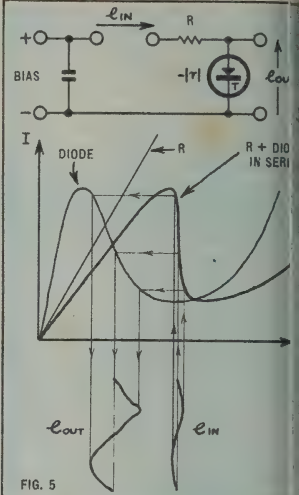

FIG. 5

with a bias change of the order per cent, approximately 75 K/s of viation is obtained.

In the circuit shown, modulatio performed by a 2N408 transistor from a crystal microphone insert. transistor is used in the common-co tor (emitter-follower) configuration serve as an impedance transformer. the high impedance microphone matched into the low impedance tu diode circuit.

Mechanically, the little transm was built in a small white plastic measuring 4¾in x 2¾in x 1¼in ove The same box has been used in the for many of our gadgets and is avail from most radio dealers (distrib locally by Messrs Watkin Wynne, Crow's Nest).

Mounted on the front of the is the small slider on-off switch microphone insert. A small piece matrix board supported by the sw terminals mounts the dry cell and t sistor circuitry and the bias pote meter is mounted on the side of box. A plastic terminal mounted the top of the box supports another p of matrix board with the diode and "circuit" and also serves as the a connector.

With the circuit shown, the should be set to zero bias and the sw turned on. Then connect a meter ac the 0.047 mfd capacitor and adjust pot. until the meter reads 120 This will place the diode in the centr its negative resistance region and circuit will oscillate. The signals be received on any normal FM rece or tuner and will be anywhere from

)5 Mc/s, depending on the diode length and position.

e to the small voltage and current of the JK9A diode, the carrier out- rom this unit is only approximately icrowatts. Thus even with an FM ver of good sensitivity the range not be more than about 20-30 feet. in this obviously crude form, the may possibly prove useful as a -range "wire-less microphone."

on completion of tests on this mitter, we set about investigating ossibility of a small audio ampli- along the lines discussed in the pre- theory article. Result? No practi- ircuit, but quite a deal of data con- ng tunnel diode amplifier opera- -mainly why at present it is not ical at audio frequencies.

CUIT

gure 5 shows the basic circuit of an ifier of this type, together with a nical explanation of its operation. may recall that for stability and voltage gain, R must approach the of r.

ice the input signal is applied to resistor R and the diode in series, an show this graphically by apply- he input Ein to a composite curve esistor plus diode in series) to re- nt the input resistance. Then since output Eout appears across the di- we may obtain Eout merely by posing across to the diode curve down. This is also shown in the am.

te that the voltage gain is indica- graphically, as one would expect. note the distortion introduced, due e diode non-linearity over its nega- resistance region. The magnitude of output voltage is fixed, being gov l solely by the range of the diode ive resistance and the degree of rtion tolerable. In addition, as the increases, the input resistance over ctive range becomes very small.

turally, this picture, representing the ded amplifier circuit, will have to nodified when a load is applied. theless, in practice where the gain d is a reasonable one (meaning the active slope of the composite is large relative to the diode alone), us distortion is incurred if more about one-third of the active diode is used.

T IMPORTANT

RF, where amplification of very l magnitude signals is performed, is relatively unimportant and the noise capabilities of the tunnel di- may be realised. This is especially of unmodulated signals and where atively uncrowded band reduces the of intermodulation.

audio frequencies, however, where tion criteria are much more import- and levels generally higher, it all ules out the tunnel diode at present. tolerable gain and distortion the able input is in the order of a few red microvolts, while the input re- ice is in the order of a few ohms.

conclusion, then, it seems appar- hat the tunnel diode at present is what of a problem child in practice. e very promising regarding high hing capabilities and high frequency ation, it tends to be very critical ding operation point, unstable when

(Continued on Page 109)

STEREO TAPE HEADS !!
NOW AVAILABLE !!

These Heads consist of a matched pair of stacked half track record-play elements within the one standard case, the same case as the Ultron series.

Pre-aligned, in-line gaps of extreme accuracy (.00016 in. gap spacers, alignment is so exact that the outputs of both tracks are fully in phase up to 20 kc.)

Overall separation is better than—45dB. Playback separation—53dB.

TWO INCOMPARABLE MODELS:—

Type TD extended range, each track same as Ultron 15T.
Type HD extreme range, each track same as Ultron 15HT.

THESE HEADS ARE BUILT TO THE SAME HIGH STANDARDS THAT HAVE MADE L.B. PRODUCTS TAPE HEADS LEADERS IN THE FIELD FOR A DECADE

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Type TD and HD (Stereo) £17/12/
Ultron 15, 15T, 15L (Record-play high impedance, extended range, .00016in gap) £9/13/6
Ultron 15H, 15HT, 15HL (Medium impedance extreme range, .00016in gap) .. £9/13/6
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HE2, HE2T (Record-play, commercial quality .0002in gap) £6/3/
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Note: "T" denotes upper half track, "L" lower half track, all others full track (except H4 and EH4, which are half track).

SEND 4/ Postal Note for a copy of MAGNETIC TAPE HEADS, containing full details of all heads, including Stereo, High Fidelit ircuits, hints to builders, etc. A FREE COPY WITH EVERY HEAD. Copies also at Tec. lcal Book Co., Swanston Street, Melbourne.

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£3/12/6 plus 12½ p.c. sales tax.
100 KCS and 1000 KCS. Frequencies Standard.
Crystals £8/10/ each plus 12½ per cent sales tax.

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PRICES ON APPLICATION.

The following fishing craft frequencies are available in F.T. 243 holders:
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Immediate delivery available for all above types.

AMATEUR TYPE CRYSTAL 3.5 and 7 MC BAND
Commercials — from £3/12/6 each plus 12½ per cent sales tax.
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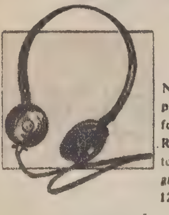

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New L. R. Headphones. Suitable for tape recorders, Radio, Mine Detector, etc., bargain price 9/6 and 12/6. (Post 3/6).

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Banana Plug and Sockets 2/6. Co-ax Plug and Sockets (Pye and Amphenol types) 5/; Army Telephone plug and socket 5/6; Standard P.M.G. plugs 3/6; Mike plugs 3/6; Jones Plug and Sockets 10 pin 8/6; 8 pin 5/6; 6 pin 6/6.

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Toggle switches: 3/6 to 7/6; Bell Pushes: 3/6 and 5/6; Circuit Breakers: 5 amp to 70 amp., 7/6; Bank of 3 toggle switches, 5/-; 4 Bank magnetic switch, 3/6. 4 Pole 3 position toggle 8/6; 3 Pole 3 position toggle, 10/6; Two position centre off toggle, 5/6; Micro switches, 5/6 to 7/6; Large DPDT Micro switch, 20/-; Rotary switches from 2/6.

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Standard telephone dials 25/-; Hearing aids brand new 35/-; Telephone handsets, 19/6; New test prods 3/6; Terminals 2/- each; Co-Axial Cable 75 ohms 1/6 yard; Relays (3000 type) Wide range of Resistances from 15 to 50,000 ohms. Prices 10/6 to 15/-; 600 types 200-250 and 600 ohms, 10/6 each.

Converters 24 volt DC to 240 volt AC, £12/10/- (5/- Delivery to Rail) Inter comm. sets with two mikes, 2 pair headphones and two matching transformers. 33/9 per kit (Post 5/).

★ BRAND NEW AMPLIFIERS

High powered R.F. Amplifiers for use with No. 11, 19 or 22 transceivers. Approx. output is 30 watts. Complete with Genemotor. £3/10/.

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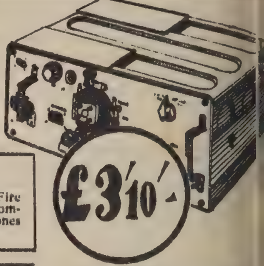

No. 22 TRANSCEIVER

The ideal transceiver for use on boats, Rural Fire Brigades, etc. 2 to 8 M/cs. Frequency coverage; Complete with 12 volt power supply. Leads and Headphones included. £12/10/- (5/- Delivery to Rail).

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Just arrived

Just imported brand new inflat air beds. Made from high qu rubberised linen and selling at attractive price of only £5/17/

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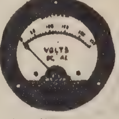

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0-15 volts AC/DC 3⅜in 55/-.
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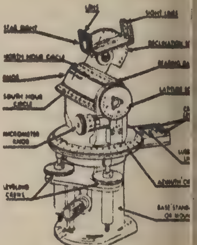
● SPECIAL VALVE THROW-OUT

807's. 5/11 ea.
Brand New



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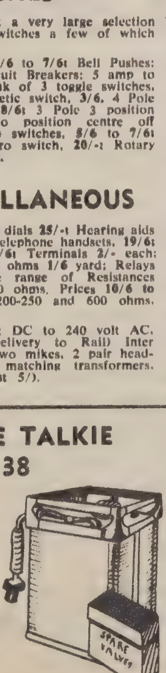
● WALKIE TALKIE
Set No. 38



Complete Walkie Talkie unit with with spare valves, control box, headphones, microphone, and aerial. (Post 10/-).

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Super Sanwa SP5. Sensitivity 2,000 ohms per volt. Checks all voltages from 0-1,000 volts A.C. and D.C. Also 0-500 milliamps on current scale. Decibel scale plus and minus 20 decibels. Complete in compact case with leads and batteries. **£5/19/6**

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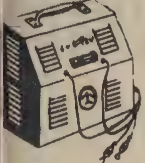

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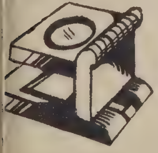

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x	20in	11/6
x	20in	21/
x	40in	39/6
x	17in	10/-
x	40in	79/6
	4ft	£7/10/

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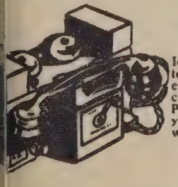

NEW ELECTRIC SOLDERING IRONS

130 watt, 240 volt, 64/6; 80 watt, 240 volt, 52/6; 60 watt, 240 volt, 48/6. (Post 3/.) RESIN-CORED SOLDER, 1/6. (Post 6d.) MELBOURNE SHOP ONLY.

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Car covers in sturdy 8oz waterproof duck. Available in the following sizes.

6ft x 8ft 45/-.
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Water bags, 14in, 12/6; 16in 13/6.
Sleeping Bags. Finest quality padded type. Two types to choose from —both with carrying bag.
Special (with hood) .. £4/12/6
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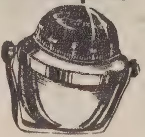

An extremely versatile gimbal mounted liquid damped compass suitable for boat or car. **Double** chromed for extra rust protection. Fully compensated.
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20 x 65, £29/15/-.
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Others (as illustrated):

8 x 40	£15/15/-
8 x 30	£8/19/6
7 x 50	£16/10/
10 x 50	£16/10/-
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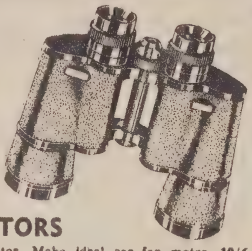

● SMALL MOTORS

12 or 24 volt reversible motor. Make ideal car fan motor, 19/6. (Post 3/6)

24 volt AC/DC constant speed motor. Good model motor 25/-. (Post 3/6)

Lens Equipment — Eyeglasses, Etc.

Linen Tester (Shown at left) also ideal for stamps. Very powerful 12/6.
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Folding magnifying glass. Double lens 8 magnifications 15/-. (Post 1/-)

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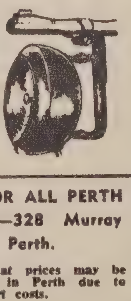
RIFLE SPOTLIGHT

4½in sealed beam spotlight supplied with adjustable bracket for mounting to rifle or gun barrel. Complete with inbuilt on and off switch and 12 feet of flex. 6-volt operation.

(Post 4/6) **84/-**



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Ideal unit for farmhouse to shed; store to factory, etc. Ex-army unit far cheaper than normal P.M.G. extensions, and no yearly rentals to worry about. .. ..

£4/9/6

(5/- Delivery to Rail)

ANDYS—FOR ALL PERTH ENQUIRIES—328 Murray St., Perth.

Please note that prices may be slightly higher in Perth due to heavier transport costs.

● HOBBYISTS

We cater especially for the man with a hobby. Large range of hobby equipment in stock to satisfy all requirements. Call in and inspect.

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Four foot tapered sections of sprung steel. Ideal for use as fishing rods. Simply screw sections together to obtain desired length. Suitable also for use as aerials, etc. 3 sections (12ft 22/6. (5/ Delivery by Rail).

● RECORDING TAPE

1,200 ft. reels of twin sided recording tape wound onto standard 7 inch plastic spools, 29/6 per reel. (Post 3/6).
Spare Spools:— 3in 3/3; 5¾in 5/6; 7in 5/11. 3,000 ft commercial spool, 7/6. (Post 1/6).

● MODEL AIRCRAFT

Super model aircraft kit, 36 inch wingspan. Ready cut for assembly. Provided with special electric motor. Complete with assembly directions and full scale plan. **£2/2/-. (Post 3/6)**

● MOTORISTS

Manifold Pressure gauges. New. Reads 20in vacuum, checks fuel consumption to further engine efficiency. **22/6.**
(Post 3/6).
Radiator Temp. Gauge. New, reads 100 to 220 deg. Farenheit. Complete with Capillary. **39/6.**
(Post 4/6
Spark plug testers, checks presence and density of spark, **5/9.** (Post 1/).
Spark plug suppressors. Stop car radio interference. **1/9 each.** (Post 6d)
Feeler Gauges. A must for every motorist. **5/9.**
Car compass—liquid damped, fully compensated. Supplied with alternative mounting attachments both suction cup, and bracket. **49/6** (Post 4/6).
Combination Stop and tail light unit. Brand new 6 and 12-volt. **14/6.**
(Post 4/6)
Petrol locking caps. Suit Holden cars. Complete with two keys. **14/6.** (Post 3/)
Car Aerials. Brand new. Side mount **55/.** Cowl mount, **57/6.** (Post 3/6)

● Crystal Set Parts

Make your own crystal set with these quality parts.

Slug tuned coil, knob and circuit ..	16/6
Crystal earpieces	7/11
Germanium Diodes	3/6
Headphones 4,000 ohm	27/6
Miniature Cabinet	7/6
Terminals	1/- each.
Aerial wire (30 yards)	3/6

(Post 3/6 part, 5/ set)

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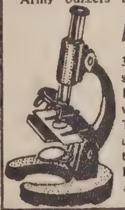
Assemble yourself model bell kits .	5/6
Assemble yourself model Motor kits	5/6
Model motors 3-volt No. 55	10/6
Model motors 3-volt No. 45 . ..	8/6
Model outboard motors 3-volt ..	19/6

● MORSE SETS

Make your own morse set.
Morse Keys, 7/6 and 5/ (Post 2/6).
Morse buzzers (3-volt) 5/- (Post 2/6).
Army buzzers adjustable 5/- (Post 2/6).

MICROSCOPES



300 Magnification microscopes ideal for students. In polished wooden box with three slides. 79/6.
Twin lens microscope. Six different magnifications, 80 to 600. Built in lighting. In polished wooden box. £6/19/6 (Post 8/6).

Let's Buy An Argumen

ABOUT VARIOUS THINGS

To judge by all the signs, our recent article on worn pickup styli (June 1961, page 72) really hit the spot. Those concerned with supplying replacement styli tell that it stimulated an immediate and very obvious demand. Here's hoping that a few less record grooves will be chewed as a result—at least for as long as the article is remembered!

WRITING from Melbourne, one supplier expressed his pleasure with the article and went on to say:

"We can assure you that the article has created an immense amount of interest, even to the point of being fantastic. It has stimulated stylus sales and proved the point that 'Radio, Television and Hobbies' does bring to the notice of the customer manufacturers' products and items of interest."

Then, from Adelaide, came a letter in these terms:

"Your article about worn styli will, I hope, induce not only retailers and servicemen but, more important, manufacturers of records, 'grams and styli, to do something concrete towards 'stylus education' of the record-playing public. .. ....

"As the manager of one of Adelaide's leading record departments, I am all too familiar with the old complaint, 'I bought this record yesterday and found, on playing it, that the pickup jumps grooves.'

"Our answer to this is for the customer to return the record, together with his complete cartridge or stylus. In 99.9 p.c. of all cases, the stylus is at fault.

"We have for the past five years operated a 'Stylus Clinic' in our record department, fully equipped with suitable tools and a microscope. All staff are fully conversant with the stylus story, both sapphire and diamond. Believe me, the idea has paid off." (Sgnd. Manager, Cawthornes Ltd.)

Stylus problems are apparently not unknown also in Queensland. "Mary Kathleen" is a name which suggests only uranium to most of us, but the sponsors of the locally circulated news-sheet consider the stylus problem of sufficient importance to ask permission to reprint our article.

This we were glad to give.

Last, but not least, from a manufacturer in England came enthusiastic commendation of the article, coupled with the hope that it would be given the widest possible circulation by all those concerned.

Speaking apparently of the local situation, they say:

By Neville Williams

"We seem almost like voices crying in the wilderness, when one sees advertisements talking of 5,000 playings or 'good for several years.'"

Rather than consider our figures conservative, they claim that stereo sapphires need replacing after 20-30 records, with 100 playings as a safe guide for mono LP sapphires.

Against this, diamond styli are clearly a much better proposition.

Well, there it is. It is good to know that the message has been noted so widely, but will it be remembered? Unless the trade keeps the stylus problem alive it will all too easily be forgotten again. A burst of enthusiasm, styli replaced a couple of times, then back to the old pattern.

The letter from England, however, raises another question which may well be deserving of very similar consid tion. I refer to head wear in t recorders.

It is no news that tape passing c the heads gradually wears them aw that performance drops off sharply w the gap dimensions are thus affected.

To date it has not been a very press problem on an amateur plane, beca tape machines have been used by lots people fairly sparingly over long peri The resulting impression is that t work for very long periods without s trouble becoming evident.

Of late the usage of tape equipm has been very much on the increase maintenance, including head wear, m inevitably become a more urgent pr lem. Added to this is the fact t modern high-performance heads, m of them quarter-track, are likely to more critical of wear and abuse.

TENSION ON TAPE

But how many tape users stop to th about the tension on the tape or pressure of the pad which keeps it contact with the heads? As long as tape slides backwards and forwards t don't worry. Yet it must be perfe obvious that the exact pressure of tape against the heads will influence w to a marked degree; likewise the prac of high-speed spooling with the tape heads in contact.

And what about cleaning heads gaps? Our correspondents claim t they should be cleaned, but not w harsh fluids such as carbon tetrachlor which can allegedly penetrate assembly and deteriorate the delic windings.

Then, too, they raise the question the tape's own active surface.

most of us, tape is just tape, but
surface of all tape equally smooth?
isn't, how many tape users have
sed any choice in the matter? How
they know the difference, anyway?
t be discerned by visual inspection?
tapes which claim to be smooth
smoother than others which do
ay such stress on this feature? Is
ne smoothness only to be achieved
expense of performance in other
ions?

se are all very interesting questions
am scattering them abroad quite
rately to see what comes back.
do you think?

SE PROBLEM

anging the subject completely, I
received a letter from a reader in
t Gambier, South Australia. He

given 144Mc. converter is said
ve a noise figure of 4 decibels.
ow if by some means or other
nprove the signal-to-noise ratio
weak signal by 10db (either by
ul adjustment or by adding an
-low noise preamplifier) what
w the overall noise figure of our
erter?

y improving the signal-to-noise
I mean reduce the receiver's
ibution by this amount.

e are told that you can't have
ive noise figures."

answer this question, it is necessary
rify first what is meant by the state-
that a receiver or converter has a
level of so many decibels. We
to be brief here, but, if you want
re complete explanation, I suggest
ou read what we had to say about
ubject when describing a Diode
Generator in the June and July
, 1950.

complete receiving system must in-
(a) an aerial and (b) the receiver
whether this be a composite unit
converter system.

ise components which are likely to
lice reception of signals include (1)
pheric and man-made interference;
ise generated in the aerial system
and (3) noise generated in the re-
as a unit.

nospheric noise and interference are
al problems which can be com-
only in part by external means—
ing a suitable site, filtering of mains
, using a directive aerial system,
n general, noise due to interference
tatic are dominant factors for fre-
ies below about 30Mc, so that, in
art of the spectrum, due, but not
ne, attention is warranted to the
noise sources.

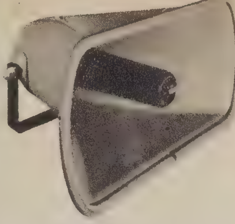
ove about 30Mc, aerial and receiver
become relatively more signifi-
and closer attention to them is war-
l.

the two, aerial noise is something
nnot eliminate, because it is pro-
by random electron motion in the
system itself. In magnitude it is
arable with the noise produced by a
r having the same source resist-
s the aerial system and at the same
rature.

refore, the noise fed into and am-
by the receiver would be the
were it connected to the aerial
ideal noiseless location, or to a re-
of the same nominal value.

sessment of receiver noises starts
this basic and finite figure.

its normal function, an idealised
er would amplify this noise with-



MODEL RECT. 20

MODERN P.A. SPEAKER
DESIGN BY
PIONEER

"PIONEER" PUBLIC ADDRESS TRUMPET SPEAKERS AND DRIVER UNITS

TYPE	DESCRIPTION	PRICE
R-25B	22in. Horn with 25 watt driver	£23 10 3
R-25E	22in. Horn with equaliser in unit	£23 10 3
R-20B	20in. Horn with 20 watt driver	£22 10 0
R-20E	20in. Horn with equaliser in unit	£22 10 0
R-15B	15in. Horn (plastic) with 15 watt unit	£21 0 0
R-12A	11in. Horn with 12 watt unit	£17 17 0
RS-8	8in. Horn with 8 watt unit	£11 0 6
R-6	6in. Horn with 6 watt unit	£8 2 10
RECT-20	20in. x 10in. Rect. Horn with 20 watt unit	£28 7 0
RECT-15A	18in. x 7in. Rect. Horn with 15 watt unit	£25 4 0
RECT-15B	18in. x 10in. Rect. Horn with 15 watt unit	£25 8 6
RECT-12A	11in. x 7in. Rect. Horn with 12 watt unit	£17 16 4
SPARE DRIVER UNITS		
UN-25B	25 watt driver unit	£9 6 0
UN-20B	20 watt driver unit	£9 4 6
UN-15	15 watt driver unit	£8 2 10
UN-12A	12 watt driver unit	£7 16 0
SPARE DIAPHRAGMS		
D-15	15 watt Diaphragm for UN-15 Driver	£1 11 6
D-25	25 watt Diaphragm for UN-25B Driver	£1 11 6
D-25E	25 watt Diaphragm for UN-25E Driver	£1 11 6
TRANSFORMERS		
TR-3	Input Impedance (Z) 600, 2.4K, 1.8K and 1.2K ohm. Output Impedance (Z) 8 and 16 ohm	£4 10 0

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RECORD PLAYER AMPLIFIER

A most compact and lightweight unit combines a 4 watt amplifier with two inputs, one for the built in 4 speed B.S.R. Record Player and one for a crystal microphone. Each input has its own volume control and a tone control with on-off switch provided. Two outputs are also available, one operates through the built-in oval speaker and a jack is provided so that a suitable external speaker can be connected. The case is finished in attractive two toned leatherette. Ideal for parties or playing records etc. at home.

Well worth 35 gns.

Price only £19/10/0

Extension Speaker, 6 inch, in leatherette covered box. Worth £5, **our price 69/6.** Larger sizes also available.

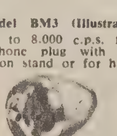
Crystal Microphones to match this unit are available from **25/** upwards.
Record Changers—Extra Special sale of brand new 4 speed record changers in original carton. Well known make complete ready for installation, plays 7, 10 or 12 inch records. **Bargain price at £9/19/6.**

Record Changer as above but mixer type, very well known make will give excellent reproduction of all sizes of records. **Price only £11/19/6.**

PIEZO CRYSTAL MICROPHONES

Model BM3 (Illustrated)

Response 100 to 8,000 c.p.s. fitted with 6ft cable and phone plug with on-off switch. Can be used on stand or for hand use. **Price only 57/6.**

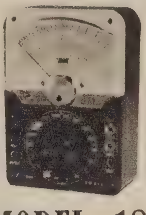


Model SM2 (Illustrated)

Response 100 to 8,000 c.p.s. Chrome-plated and phone plug. This is a really versatile microphone, suitable for attachment to any stand. **Price only 45/.**

Model LM1

Response 100 to 8,00 c.p.s Chrome-plated finish with 6ft cable. A very popular model. **Price only 25/.**



MODEL 180 TMK MULTIMETER

This is a compact and reliable precision laboratory type instrument, and ideal for use of Radio and TV Servicemen, Electricians, Motor Mechanics, etc. Ranges as follow:—

D.C. Voltage: 0-0.6, 6, 30, 120, 600, 1200, 6000 volts at 20,000 ohms per volt.

A.C. Voltage: 0-6, 30, 120, 600, 1200 volts at 10,000 ohms per volt.

D.C. Current: 0-60 microamps, 0-6, 60, 600 mA and 0-12 amps.

Resistance: 0-5000, 500,000 ohms, 0-5, 50 megs.

Decibels: — 20 to + 63 db.
Dimensions: 3 5-16 x 6 5-16 x 2¼in.
Weight: 29oz.

Price £13/15/, plus 12½% tax. Total, £15/9/5, plus postage.

MODEL 200 TMK MULTIMETER

This instrument is a compact and reliable high sensitivity meter designed for use in the production, servicing and maintenance of electronic equipment.

Specifications:—

D.C. Voltage: 0-0.6, 6, 30, 120, 600, 1200 volts at 20,000 ohms per volt.

A.C. Voltage: 0-6, 30, 120, 600, 1200 volts at 10,000 ohms per volt.

D.C. Current: 0-0.6, 6, 60, 600 mA.

Resistance: 0-10,000 ohms, 100,000 ohms, 1 meg, 10 meg.

Capacity: 0.002—0.2 mfd.
Decibels: — 20 to + 63 db.
Dimensions: 3⅝ x 5¼ x 1⅜ inches.
Weight: 11oz.

Price £9/15/, plus 12½% sales tax, £10 19 5, plus postage.

SPECIALS

1. Oak Switches 3 pole, 3 position, 2 gang. Worth 20/3. **Our price 6/9.**
2. Oak Switch Wafers only, 3 pole, 3 position, 1/ each.
3. **Inverters:** 6 volt to 230 volt and 12 volt to 230 volt available, 40 Watts output at 50 c.p.s. These are ideal for working Electric Shavers, Radio Receivers, Record Players and also fluorescent lights, etc. Normal price £13 15/. **Our price £7/10/-**
4. Small 2 gang condenser 12 PF to 450 PF capacity. Price only **10/ ea.**
5. Miniature 2 Gang Condensers few only at **10/- each.**
6. Miniature 2 Gang Condensers with vernier drive. Worth 35/. **Our price 18/6 ea.**

SPECIALS

7. Few only 4 x 5 speakers new. Worth £
Our price 22/6.
8. The following Radio Valves are all gua anteed in new condition; most are sti in the original cartons.

6R7	5/-	42SPT	4/
6U7G	10/-	PM24M	4/
49	5/-	FC20	4/
47	10/-	SP2	2/
46	4/-	KDDI	3/
45	7/6	ARP34, EF39	5
37	4/-	KC3	2/
36	5/-	FC13	2/
34	4/-	12SR7, VT133	10/
33	5/-	12SG7	7/
32	3/6	12SQ7	10/
VT31/31	2/6	12SN7GT	10/
27	3/6	12A6, TV134	7/
26	3/-	58	5/
19	4/-	77	4/
VR91, EF50	5/-	85	4/
2A3, VT95	12/-	ABC1	4/
VT120, 954	4/6	AK2	7/
CV1130, VR130,		CB1	7/
HL23	2/6	CF1	10/
VT138, 1629	3/-	1L5G	7/
240	2/6	CK1	10/
PM254	3/6	CY31	10/
ZA7023, VP23,		CV62, E1046	5/
ARP12	5/-	7C7	3/
NR74, AC6	4/6	35/51	5
CV65, PEN25	2/6	VT153, 12C8	4/
A642	2/6	CV2511, 420T	2/
B605	2/6	VR502, KT32	4
VT501	2/6	VT49, 39-44	5/
506	5/-	1M5G	7/
A435	2/6	AV11	3/
B409	2/6	7A4	5/
B443	2/6	VT75A, KT44	3/
EL50	5/-	6AC7	7/
6K6GT, VT152	5/-	1D5GP	3/
VR54, EB34	4/-	1F5G	4/
41FP	2/6	1C7G	10/
VT52, EL32	5/-	6R7GT, VT22B	5/

9. **Magnatenna** designed to use a Portab Radio set in the car. The Magnatenna fastened inside the window by means suction cups. Normal price 39/-, O Price, 21/-.
10. **Wire Wound Potentiometers.**

1,000 ohms	4
1,500 "	4/
2,000 "	2/
2,500 "	5/
20,000 ohms	5/

11. **Carbon Potentiometers**

10,000 ohms	2/
20,000 ohms	3/
½ meg with SP Switch	5/
1 meg with SP Switch	5/
1 meg with DP Switch	6/
1 meg tapped with DP Switch	6/

12. 5-pin Wafer Sockets .. .. .. 6d eac
8-pin Wafer Sockets .. .. .. 8d eac
13. 5-pin Marquis Speaker Plugs, 6d eac
14. TV Plugs and Sockets to mount on ski ing board, ... 2/- pai
15. TV Mast stand-offs clip on type for 1 mast 10d each, 1¼in mast 1/- each.
16. Brand new, TV Tuners turret type, we known make, guaranteed. Worth, £19/19/ Our Price, £10/10/-.
17. **Morse Buzzer Sets.**
Ideal for learning the code, have key an buzzer, can be connected to lines. Pric only 5/- each.
18. **Neat Record Players for Stereo.**
These are mounted on attractive woode base and consist of a good quality tur table with stereo pick-up, two outlets, eac with its own volume control ready to b connected to two external amplifiers. A ternatively two signal amplifiers could b mounted under the base. Price of this un has been reduced from £25 to £12/10
19. Imported Red and Black Test Prod Worth 5/- pr. reduced to 3/- pr.
20. 21in TV Masks, new and perfect. Only 5 each.
21. Imported crystal sets, midget type wi indoor aerial and earth wires and cryst earpiece. Worth 57/6, reduced to 25/ e
22. Job Speaker Windings, a large variety available. Let us know core sizes and in pedence when ordering. Price only 2/- e

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BRANCHES THROUGHOUT VICTORIA AND RIVERINA

tributing to it noise from its own
circuitry.
ct, there is no such thing as an
ceiver and all practical units add
ing to the basic aerial noise.
efore, all other things being equal
vity, bandwidth, audio response,
practical receiver connected to a
aerial or its equivalent resistor
roduce greater noise output than
lised receiver. In fact, the merit
practical receiver, in respect to
ontribution, can be expressed very
by observing the ratio of its
ise output to that from the ideal-
it. A ratio very close to unity
indicate a very small noise contri-
and therefore a very good prac-
ceiver.

R TERMS

esort to more definite terms, it
mary to base the ratio on a power
ement and to express it in deci-
the "noise figure."
way of example, a practical re-
may be found on test to produce
noise output of 50 milliwatts,
nting the sum of the source noise
own internal noise. From the
of the instruments involved, it
be deduced that an idealised re-
under the same conditions, would
only 25 milliwatts.
the ratio of noise power from
ctical receiver to that from the
d receiver would be 2:1. This
nts a figure of 3db. and, accord-
he practice explained, the receiver
be credited with a noise figure of
a rather gratifying figure, I might
n.
he contribution of the receiver
be reduced to 10 milliwatts, as
ed to the same aerial source
the ratio of 35 to 25, or 1.4:1,
represent a noise figure of 2db.
, notice this: An improvement of
ibel, from a noise figure of 3 to
involved a two-and-a-half times
tion in the noise power from the
er itself.
go a step further and assume that
eiver is improved to have a noise
of 1 decibel. This means that it
d only 1.5 milliwatts of noise to
caused by the aerial, representing
of 1.06.
note again: The 1 decibel reduc-
om 2 to 1 has involved an im-
ent in the receiver's own charac-
of 10/1.5 equals 6 times. (I am
round figures.)

LY SPECTACULAR

's impressive enough, but the final
is really spectacular. To reduce
ise figure from 1db. to zero would
reduction of the receiver's noise
ution from 1.5 milliwatts to zero.
e that, and you have achieved
ion. You have brought about in-
mprovement in the receiver's own
l noise characteristic.
in lies the answer to part of our
ondent's question: Though impos-
f achievement, a noise figure of
vould represent perfection in the
r itself. The receiver would add
g to the noise created in the aerial

note that the overall system would
t be noise-free. It simply means
e ratio of aerial-plus-receiver noise
al-noise alone is 1:1, and we are
ft with this noise as a basic prob-

egative noise figure would mean
e receiver, by some magic of can-
n, actually diminished this basic noise! No, there is no basis for negative noise figures.

But, of course, our contributor may argue that, if he were to reduce the equivalent noise power from 25 milliwatts to 2.5 milliwatts (merely repeating a couple of typical figures), that would represent a ratio of 10 times, equivalent to 10db.

That is perfectly correct, except that he is talking about a simple ratio of improvement in the receiver itself, unrelated to any reference level. He is NOT talking about The Noise Figure, subject of our original definition, and related to a definite base quantity.

It is no more logical to subtract decibels related to one subject from decibels related to another, than it is, in primary school arithmetic, to subtract apples from oranges.

FM BROADCASTS

By way of conclusion, a reader from Glen Osmond, S.A., writes in support of our editorial in the August issue, regarding the retention of F.M. broadcasting. He encloses a copy of a letter which he sent recently to the Postmaster-General on this subject. It may contain food for thought:

The Postmaster General,
CANBERRA.
Dear Sir,

An examination of the placement of the National Television Stations as outlined in your announcement of the 3rd July in relation to the topographical features of the areas would indicate that, unless there are some very obscure technical reasons Channels 4 and 5 could very well have been done without, and their frequencies allowed to remain for the usage from which they were taken.

Channel 6 could have been used for Morwell and Channel 3 could have been used for Newcastle, and even at this late stage one feels that the error of discontinuing FM broadcasts, especially in the face of increasing antagonism, could readily be rectified, the recipients of the Contracts for Channels 4 and 5 could hardly object to a variation of frequency to 6 and 3 respectively.

I refer you again to leading article in current (August) issue of Radio, Television and Hobbies.

Yours faithfully, (Signed) A.H.

RADIO IS A REWARDING HOBBY

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(vide. "Mullard Outlook," Vol. 4. No. 3) wound to Mullard specification.
T1. Antenna Coil and Ferrite Rod.
T2. Oscillator Coil.
T3. Bandpass Filter Primary.
T3A. Bandpass Filter Secondary.
T4. Demodulator Transformer.

The complete Kit, as above, £3.

Output Transformer 200 3.5. .. .. 15/6
or **200/15** 17/6
Driver Transformer to order. 17/6

Corelocking Compound (Highest quality Grade A. — imported. 3.5 kilopoise at 68 degrees F., silicone base). Bulk stock enables us to offer at only **5/6 a jar** — worth 15/.

Coil Laquer. Polystyrene Base, guaranteed not to effect Q-factor; also a most useful cement for repairing cracked and broken plastic (styrene) radio cases, knobs, etc. **Only 4/6 a jar.**

All prices quoted **INCLUDE** Sales Tax and Postage anywhere in Australia. If registered post required, please add 2/.

EXPERIMENTERS — PROFESSIONAL AND AMATEUR — send stamped addressed envelope for free list R.F. and A.F. transistor application R.F. and A.F. coil and transformer components — single item or small quantity formers, cans, bobbins, laminations, wire packs (including Litz.), etc.

We are quality and specification conscious and are pledged to prompt service and reasonable prices.

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P.O. Box 6, Bayswater, Victoria.

PARAMOUNT RADIO & DISPOSAL STORE

32 McARTHUR PARADE, DULWICH HILL.
WB2260. **WB4461.**

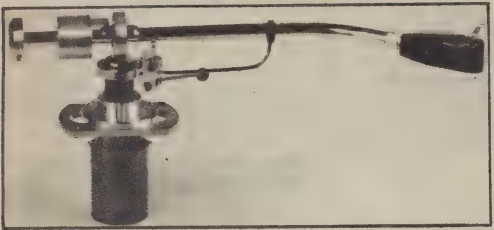
RECEIVERS. Multi-band, including preselector, 2 RF stages, variable selectivity, Magic-eye tuning, pro for mic. and gram inputs, voltage regulated AC power supply	£20/0/0
AR8 Receiver .. .. £16/0/0. Philips No. 4 AC, DC operated	£12/0/0
P.A. EQUIPMENT. Horn speaker with DA7 driving units, good condition	£10/0/0
Twin-horn Speaker with built-in driving units	£3/10/0
Heavy Duty Driving Units less horn	£2/10/0
Metal Rectifiers. Suitable for battery charging, can handle current to 10 amps work. Each	£1
Batteries, Nickel Iron NIFE type, 2.5 volts, 21 amp hours. Each	15/-
TEST EQUIPMENT. Paton Valve circuit tester	£9/0/0
Philips Signal generator	£9/0/0
Huge supply of English Valves, CV series.	
NAVIGATION EQUIPMENT. Compass and Binnacle	£6/10/0
Navigation Charts, all localities, 3/- each.	
Aldis Lamps, Admiralty pattern, new, in case, 12, 24, 32 volt	£12/0/0
Navigation Lights, electric, white, red, green. Set	£4/10/0
Navigation Lights, replacement glasses, 6/- each.	

DETAILS OF OTHER ITEMS AVAILABLE MAILED WITH ORDERS.

NOTICE.—Intending purchasers, other than Mail Order customers, may purchase items from No. 3 Mail Order Store, between 9 a.m. and 12 noon Saturday only, at **32 McArthur Parade, DULWICH HILL.**

TRADE REVIEWS AND RELEASES

S.M.E. PRECISION PICKUP ARM



This side picture of the S.M.E. arm shows the adjustable sliding counter - weight, with the lateral balance weight just visible behind it. Note the dashpot lowering device to the right of the bearings.

Pictured above is the now famous S.M.E. pickup arm, the most elaborate and most expensive to be described in these columns. Built to extremely high standards by S.M.E. Ltd., Steyning, Sussex, it is an arm which has become popular with connoisseurs the world over.

IN producing the S.M.E. arm, the makers have obviously set out to anticipate all the problems which have worried enthusiasts through the years.

Firstly they have paid close attention to securing freedom from bearing drag so that, when adjusted for optimum balance, a soft breath is sufficient to move the arm in any direction.

Horizontal balance is achieved in the first instance by a spring-loaded sliding counterweight on the arm overhang. A minor weight on the side remote from the disc is used both to provide torsional balance and, with the aid of suitable calibrations, to set the weight on the stylus point.

To provide easy adjustment for tracking, the whole pivot mechanism can be slid backwards or forwards along the slotted base plate. Vertical height of the bearing column is also adjustable.

A notable feature is the lever and dashpot mechanism which can be used to lower the pickup onto the disc or to raise it after or during playing.

Highly flexible leads carry the signal through the pivot column to a shielded terminal strip below the motor board.

A recent innovation is an attachment involving a thread and a small weight, which can be adjusted to offset the natural inward throw of any pickup, due to drag on the offset head.

The head shell itself is readily removable and is designed to accept most magnetic cartridges.

In short, this is an expensive arm but it is a very good one, and one which can be mated to advantage with the kind of cartridge which record connoisseurs are likely to choose. Sole Australian Distributors are Jomyson Industries of 400 Kent Street, Sydney. Supply is available through high fidelity dealers throughout the Commonwealth. List price of the model 3009 illustrated is £44.

NEW HAND TOOL MAKES LABELS

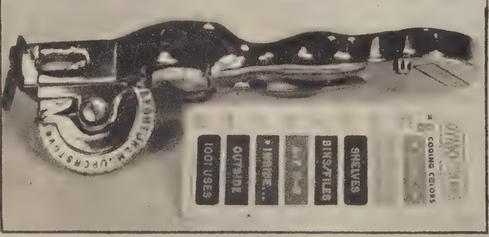
Illustrated below is the new "Dymo-Mite" hand-held "tapewriter" recently released in Australia by Wm. J. McLellan & Co. Pty. Ltd. of 126 Sussex St., Sydney.

MANUFACTURED by the Dymo Co of Berkeley, California, this device may be used to emboss either letters or numbers into a special pressure-sensitive plastic tape. This tape, which is available in a range of nine colours, has a self-adhesive backing and may be attached to almost any type of surface, including wood, brickwork, plaster, etc.

It should be ideal for use by electricians for labelling switchboards, etc., obviating the need for unsightly hand lettering. Though adhering firmly, the labels can be peeled off and replaced to keep pace with wiring changes.

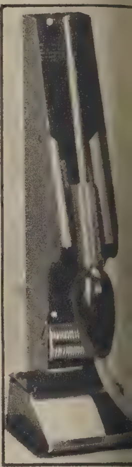
Operation of the device is simplicity itself, the tape being automatically fed from a container in the handle as each letter is embossed. A built-in cutter blade slices the tape off upon completion. We had no difficulty in producing a perfect label at first trial.

In brief, an extremely handy little gadget which should find ready application wherever individualised labels are required for switches, radio equipment panels, shelves, bins, files, etc.



SOLDERING IRON AND STAND UNIT

With the current trend towards the use of low voltage in soldering irons, it is interesting to note that the latest iron to be submitted for review is designed for direct 240-volt operation.



OF English manufacture the iron, along with a range of accessories, has been released in Australia by Adcola Products Pty. Ltd., of 420 St. Kilda Road, Melbourne.

One of the most interesting features of this product is the unique stand, illustrated, on which the iron rests when not in use. Designed for upright mounting to conserve bench space and take the heat away from the handle when the iron is not in use, this stand has solder, emery paper, and a piece of sailcloth mounted in its base to facilitate the periodic cleaning and re-tinning necessary w any iron.

Among the accessories available i large range of special purpose b attachments for hand-operated ther cable strippers, etc. The iron its is available in wattage ratings from to 27 watts and 7 voltage ranges fr 6 to 240 volts.

Our tests showed that an operat temperature sufficient for normal sold ing was achieved in approximately minute, although, after prolonged the barrel of the iron did tend to come rather hot.

NEW RANGE OF TRANSISTORS

NEWMARKET Transistors Ltd. of Cambridge, has released new range of industrial quality transistors.

These are all of the germani P.N.P. type and include a wide select of high speed switching transistors power transistors.

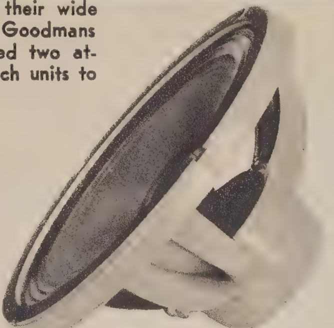
The switching transistors are enc sulated, conforming either to Jedec TC or TO5 outlines.

The power transistors incorporate their range such characteristics as Be of 60 at 6 amps; 60 volt collector rati at 6 amps; 60 degrees C junction te perature above ambient; 60uA leak current.

Further information on the range m be obtained from Tecnico Electro Pty. Ltd., P.O. Box 12, Marrickv N.S.W.

GOODMANS AXIOM SPEAKER

ell known for many years for their wide ıge of high fidelity loudspeakers, Goodmans dustries Ltd. have recently added two at- ıctively priced high-quality 10-inch units to their range.



ESE are the 10-watt Axiom 110 lustrated and the 12-watt Axiom Each has a claimed frequency re- of 40 to 15,000 cycles, funda- l cone resonance of 45 cycles and pedance of 15 ohms at 400 cycles. nly difference in their specifications the flux density of the gap which 000 gauss for the smaller 10-watt and 16,000 gauss for the 12-watt

the enthusiast who requires heavier and greater power handling capa- han is possible with the average 8- system, yet retaining some economy ce and space, these units will inevit- prove to be of great interest. Re- rice of the Axiom 110 is quoted as 6, while the Axiom 112 lists at 2/6.

ıtures of their construction stressed ıanufacturer's literature are the terminated hyperbolic diaphragm, die-cast chassis, precision wound long aluminium voice-coil and the ormed impregnated, corrugated suspension, which gives a linear /deflection characteristic with maxi- centring action.

our listening test we found the bass nse to be smooth and adequate, in little different from the larger m units. Treble response appeared slightly less prominent than from an earlier twin cone 12-inch unit but, by the same token, it appeared to be commendably smooth.

Data supplied with the speakers gives designs for typical enclosures.

PICTURE TUBES FOR TRANSISTOR TV SETS

SYLVANIA Electric of U.S.A. have recently announced the release of experimental picture tubes for use in transistorised television receivers. The new tubes are designed to minimise deflection, video drive and heater power requirements. Details may be obtained from Automatic Electric Telephones Pty. Ltd., 86 Holdsworth St., Woollahra, N.S.W.

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Stockists of Television parts, Picture Tubes and Turrets

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Pye Wave Meters 100-2500 Kc Xtal calib. int. mod. AC supply **£25.**
Selsyn Motors, **20/ ea.**
100 MA Meters **25/ ea.**
Meter Rectifiers 1 and 5 mA, **12/6 ea.**
10 core TRS flexible cable, **1/3yd.**
Chokes from **4/-.** Coils from **2/ ea.**
Marker Buoy Xmitters 3 valve **22/ ea.**
Earphones with head-band **7/- ea.**
New Earphone Leads and Mike Plug **2/11 ea.**
Mike Transformers and chokes, **4/- each**
NEW BATTERY SALES and SERVICE at FACTORY PRICES. 2-Year Guarantee.
Postage and Freight extra.

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Cnr. Cardigan and Rowleys Sts.,
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LOWTHER

AUDIOVECTOR

A compound folded horn designed for the enthusiast who demands the best that money can buy, without compromise.
The Audiovector should be treated as a musical instrument rather than just a "loudspeaker," great care having gone into the design and manufacture in order to achieve a unique definition of reproduction.
Employs PM4 or PM2 Drive Unit. The PM4 (illus.) has a total magnetic flux of 385,000 Maxwells, and a frequency response of 20 to 24,000 c.p.s. Sensitivity is high, and only a few milliwatts are required for small studio monitoring. Heavy wattage may be connected for full dynamic range. Overall efficiency with PM4 is 50%. Prices on application.

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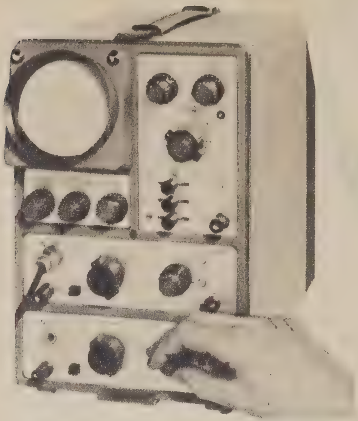
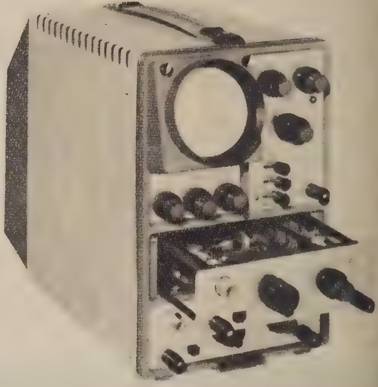
It is portable . . .



and the plug-in amplifiers give it extreme versatility.



Telequipment's new D33 double beam SERVISCOPE

with Type A amplifier

£199/1/- f.i.s. all capital cities slightly less in Sydney

JACOBY, MITCHELL
and Co. Pty. Ltd.
469-475 KENT STREET,
SYDNEY. MA8411.
Also at : Melbourne,
Adelaide,
Newcastle.

The amplifier plugs into circuit as it is slid into place from the front of the instrument. The oscilloscope itself uses a 3½in flat faced p.d.a. tube, operating at 3.5 KV.

A—General Purpose Amplifier

A standard form of amplifier with a wide frequency response (6 M/cs), and the additional facility of X10 sensitivity, when needed, over a limited bandwidth (200 Kc/s). Many applications, especially in servo, computer, TV and radar development and maintenance.

B—Differential Amplifier

This unit gives high gain with differential input, maximum sensitivity is 1 mV/cm D.C., frequency response is 200 Kc/s. It adapts the D33 to work in the electro-mechanical field—involving strain-gauges, transducers, etc.—and to medical and biological applications.

C—Ultra-high Gain Amplifier

Maximum sensitivity is as high as 100 uV/cm A.C., frequency response 5 c/s to 150 Kc/s. Primarily for applications in the electro-acoustical and magnetic recording fields.

ECHNICAL BOOK REVIEW

**CIPLES OF TRANSISTOR CIR-
UITS: Introduction to the design
Amplifiers, Receivers and other
ircuits. 2nd edition. By S. W.
mos, B.Sc. (Hons.), A.M.I.E.E.
ublished for "Wireless World" by
iffe Books Ltd. Hard cover, 8¾
y 5½ inches, 210 pages including
25 diagrams in the text.**

first two chapters of this book
with the physics of the junction
and the transistor. These chapters
t intended to deal comprehensively
he physics of semiconduction, but
ve just sufficient information to
as a basis for understanding tran-
properties and to enable the reader
no previous knowledge to under-
what follows. The bulk of the
is devoted, as in the first edition,
study of the principles underlying
sign of transistorised equipment.

ing the period following the pub-
n of the first edition in 1959 and
ublication of the present edition
have been a number of significant
pments in the science of semi-
ction. The chief of these has been
eplacement of the point-contact
stor by the drift transistor in RF
ations. To bring the book up-to-
appropriate changes have been
to the text of this second edition;
ference to point-contact transistors
een omitted and the space saved
een devoted to drift transistors and
applications to pulse amplifiers and
receivers.

Other new topics included in the present edition are voltage reference diodes and controlled rectifiers. The sections on transistor multivibrators and on miscellaneous applications of semiconductor devices have been considerably expanded and are now included as separate chapters.

The fairly heavy pictorialisation should be of considerable aid to a complete understanding of the text material. A large number of worked examples are included, the mathematics of which is confined to simple algebraic manipulation. These show the order of practical magnitude of the various electrical quantities involved.

There's a strong chance that another reader has the very item you want for your experiments. The chances are he isn't even using it! Why not advertise for it next month, on the blue page at the back of the book?

Throughout the book the design of amplifiers and receivers has been given the greatest prominence. However, details are given of a number of other semiconductor uses including such things as photo-sensitive devices, relaxation oscillators and DC to DC converters, etc.

Our copy came direct from the publisher, Iliffe Books Ltd. Copies should be available shortly on the local market. No Australian price has yet been given. —(KWJ).

THE SURPLUS HANDBOOK, Volume 1.—Receivers and Transmitters by Charles Caringella, W6NJV, and Richard Clark, W6NJE, and the Editors of "Western Radio Amateur." Published by Editors and Engineers Ltd., of Summerland, California. Soft cover, 94 pages, 11in by 8½in.

The value of a piece of armed services surplus electronic equipment is considerably enhanced when one is in possession of the circuit diagram of the equipment. This book then should be of interest to amateurs wishing to convert such equipment to their own use.

Unlike some previous publications of this nature, no attempt has been made to give modificaiton details of the equipment. Instead, the authors have included as large a range as possible of receivers and transmitters arranged according to their service's numbers in alphabetical and numerical order.

Complete circuit diagrams are given of some 47 pieces of popular surplus equipment and each circuit has an accompanying photograph of the equipment to assist with identification. Good quality paper and an excellent printing job means that even the most complicated of circuits is easily followed. The larger circuits are of the "fold out" style.

In addition to the many circuits and photographs, the book also contains a nomenclature of equipment indicator letters and a complete services-to-civilian cross reference guide of the various valves contained in the equipment.

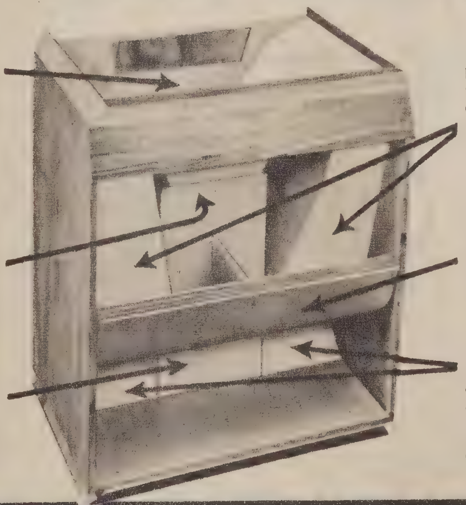
Our copy came from the Technical Book Co. of Swanston Street, Melbourne. Price is quoted as 40/.—KWJ.

LOWTHER AUDIOVECTOR

(1) Front-loading exponential horn for middle and high frequencies, facing upwards. Special hard plaster cast horn prevents unwanted resonance arising, and adds clarity customary to "Lowther Sound."

(2) Pressure chamber containing Lowther Drive Unit PM4 or PM2, with stabilizers. Visible in reflector near mouth of (1).

(3) First development of back-loading bass horn, wave front proceeding downwards.



(5) Third development, bass horn. The two bass wave fronts are now proceeding downwards again towards rapidly flaring horn mouth.

(6) Bass horn's curling upper lip. The divided back-wave unites into one powerful in-phase signal extending clearly down to 35 c.p.s. with overall efficiency of up to 50%.

(4) Second development, bass horn. Wave front divides symmetrically and horizontally, then proceeds upwards in gentle curve at rear of enclosure.

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OFF THE RECORD — NEWS & REVIEWS

AUDIO REDUCES PAIN, TENSION

One of the most interesting developments of late in the audio field is the rising interest in audio analgesia, particularly as an aid to dental surgery. It warrants mention here because it is a natural extension of high fidelity stereo sound, stereo headphones and other forms of "personalised" listening. It could also mean new and acceptable business to those interested in supplying equipment.

By Neville Williams

FIRST let me stress that, while having something very general to say about the subject, I am not by any means expert in it. In fact, very few are, at the time of writing. It is still a matter for much argument and speculation.

Secondly, there is nothing specially mysterious — at least on the surface — about audio analgesia. No mystical sounds are involved, nor is there any question of such sound replacing the anasthetics which are so much a part of dental surgery.

Audio analgesia is intended primarily as an aid to both patient and dentist, supplementing established methods.

Audio analgesia depends to a large extent, for its effectiveness, on the apparent fact that the severity of pain felt by an individual is related to the circumstances of the moment.

As an illustration of this, people frequently treat minor injuries very lightly, when on the sporting field or in other circumstances where their attention is occupied primarily by other matters. The inference drawn is that patients in a dental chair, for example, will be less aware of discomfort if their attention can be diverted, even partially, from the dentist and his activities. Audio, or more particularly a selected type of audio, happens to be a convenient method of doing this.

TOTAL STIMULUS

A second line of thought suggests that there is a limit to the amount of total stimulus to which the human senses can react. If a large amount of "acceptable" stimulus is provided, in the way of music and/or other sound, it raises the threshold of sensitivity and makes the individual that much less aware of "unacceptable" stimuli.

In general support of this idea, it is claimed that workmen exhibit loss of judgment and also pain perception while subject to extreme noise.

In a modern, fully sound-equipped dental surgery, we are told, there would be continuous, diffused background music in the waiting room. This would not be taken from broadcast stations. Neither would it be a collection of the la
pops nor, at the other extreme, of h
brow discs, dear to the heart of the
geon.

It would be "middlebrow" m
tuneful but deliberately chosen for
smooth, restful qualities. Such musi
currently being made available over
on wired circuits and FM multi
channels, to serve stores, restaurants,
—for a suitable charge!

Discreetly used in the waiting ro
such music has a relaxing effect on r
patients, as well as submerging s
of the faint "oohs" and "aahs" w
are often to be heard in such a local

Inside the surgery, similar m
is available to the patient through h
phones or other form of "personali
listening as, for example, from n
ature loudspeakers built into the
rest. Here the problem becomes ra
more specialised.

Since the basic idea is to capture
patient's attention as much as poss
yet without producing an annoyance
action, a good case can be made
stereo sound, fed correctly to the res
tive reproducers. Other things b
equal, stereo sound will capture the
tention much more effectively than m

However, simple music is not the
plete answer to the patient's need
cause, by its very nature, it is i
mittent in character and, during
"quiet" periods between notes
chords, the patient can hear the s
of the drill, etc., without much im
ment.

This has led to the idea of mi
so-called "white noise" with the m
to fill in the quiet moments.

"White noise" is something like
hissing to be heard from a sens
short-wave receiver, in the absence
signal or atmospherics. A sim
smooth, high-pitched hiss can somet
be heard from a sensitive ampl
when no sound is being reprodu
Acoustically, is approached closely
the hiss of escaping steam. It is s
containing energy spread throughout
whole audible spectrum.

Because it does contain all freque
it can be mixed with music wit
creating dissonance. It provides a
tinuous background, while the m
adds moment-to-moment interest.

In point of fact, some claim that
music is unnecessary; that white
alone achieves all that is required. O
claim that music alone suffices but
seas opinion appears to be that the
bination of the two is best.

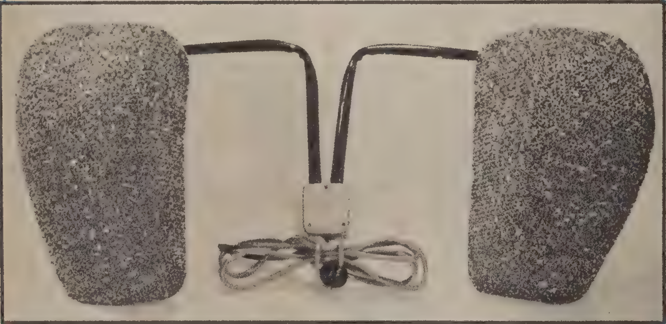
CONTROL UNIT

In addition to the actual sound,
most ambitious schemes make avai
a small control unit which the pa
holds in the lap. By twiddling the k
they can vary the proportion and
ness of the sound to suit their req
ments. It is claimed that occupation
the controls and the ability to do s
thing effective with their hands is a
ther aid to the patient.

Though the exact result of all this
on the patient may be under deba
is commonly agreed that the overal
sult is beneficial to both patient and
tist.

Because of music (i.e., music

IDEA FOR "PERSONALISED" STEREO



PICTURED above is the "Mestereo Audio Headrest Reproducer" mentioned elsewhere in these columns. Attached to a tall-backed chair (see advertising illustration) they allow full "personalised" stereo reproduction; to be obtained without actually wearing headphones.

Tested in a typical lounge room situation, they gave good stereo effect, though with some loss of bass response unless the units were nestled close to the ear. Sound quality generally is good, though dependant in the ultimate on the type of loudspeaker fitted.

For good listening level, the sound could be heard plainly over a quiet room, and in this respect, the "privacy" aspect is not as good as a closely-fitting headphone. On the other hand some of the objections to headphones are overcome. The "Mestereo" unit is available with or without in-built volume controls, from 18 guineas. (Inquiries to J. A. Messer and Co., 16 Thorpe St., Glenburnie via Torrens Pk., S.A., or to the World Record Club Pty. Ltd. in captial cities.)

aiting-room, a patient enters the in a more relaxed frame of

relaxation is maintained in the hair with music and/or white alivation rate is reduced and this, with more ready co-operation, work to proceed faster. With e patients the use of an anaes- ay be rendered unnecessary for work. In other cases, the amount esthetic administered may con- be reduced.

vations to date suggest that wo-thirds of all patients visiting quipped surgeries derive positive from the scheme.

a technical viewpoint, two obvi- stions follow, namely (a) the f the composite sound signal and ype of reproducer.

stereo music is much to be pre- he obvious sources are either LP tapes. And, if the duty nurse is spend excessive time worrying hanging and selecting discs, these need to be played by an auto Tapes, if preferred, would need the longest possible playing time.

noise has been recorded on c and tape but neither system ds itself when stereo sound has rovided as well. The obvious re- nt is a simple noise generator, an be left running all day and ay, without attention. It should ble to borrow the design of such rom the field of audiometry.

erning reproducers, an obvious is the use of headphones wired eo and yet capable of producing mblance of true white noise.

interesting to note, in this con- that Messrs. Broadway Electronics, one of our regular advertisers, displayed at the Sydney Trade Fair a small unit designed for use in dental surgeries, using a stereo record changer and feeding a pair of wide-range AKG stereo headphones.

While the use of stereo headphones allows the dentist to work in relative silence, they would require to be wiped over before being passed from one patient to the next. Also, covering the ears tightly they may tend to accentuate noises produced in the mouth by drilling, etc.

An alternative approach is represented by the "Mestereo Audio Headrest Reproducer" which some may have noticed advertised in the July and current issue.

In this unit, two small loudspeakers are built into foam cushions which attach to the headrest of any tall-backed chair. They are so arranged that the speakers are heard by the respective ears when the head is allowed to rest naturally between them. For dental use, hygiene could be ensured by the use of washable drapes to go over the back of the chair and the audio units.

Arguments could be advanced for these units in preference to headphones, and vice versa, but only practical experience could establish their relative merits. In fact, both schemes should be perfectly practical.

STUDIO DENTIST

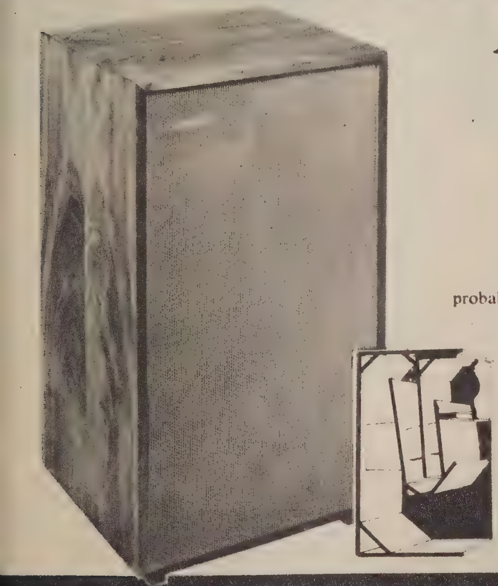
"You've been biting too much dust!"

A REVIEW OF SACRED RECORDS

HALLELUJAH. Brass of the Hollywood Bowl Symphony Orchestra, conducted by Alfred Newman, arr. by Grieg McRitchie. Stereo, Capitol SP 8529.

For those who have an ear for brass, trumpets, tubas, trombones and French horns of the Hollywood Bowl Orchestra present selections old and new, supported by pipe organ and a varied assortment of percussion.

The sound is hard and brilliant, as might be expected from a brass choir, but I suspect the overall balance. I found it necessary to reduce the treble


LOWTHER
ACOUSTA

Lowther Acousta with PM6 Driver justly deserves the title "The Musician's Speaker." This magnificent instrument will accurately reproduce every nuance of each instrument in the orchestra with realism, sparkling transparency, and dynamic attack. Lowther high-flux permanent drive units, horn enclosures, and amplifiers, are designed and manufactured by Mr. Donald Chave of England, probably the world's most dedicated audio designer.

Lowther drivers incorporate the highest attainable kilo-gauss per kilo-gram, and radiate a crisp yet warm quality, entirely lacking in conventional reproducers. The fully imported ACOUSTA is a compact and complete speaker system with simple, clean lines. Available in a variety of selected woods, highly polished or hand-rubbed and waxed. Price approximately £110, depending on finish. Teak, Italian Walnut, English Oak, African Mahogany, Maple.

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Goodmans
10" Axioms
PASSED WITH
HONOURS

Goodmans loudspeakers are subjected to the most severe examination in the anechoic chamber, shown above, during both development and subsequent manufacture, ensuring that your GOODMANS HIGH FIDELITY LOUDSPEAKER has "passed with honours" and that its performance will justify your choice.

AXIOM 110
PRICE £10/6/-
Power Handling : .... 10 Watts.
Flux Density : .... 12,000 Gauss.

AXIOM 112 as illustrated
PRICE £15/12/6
Power Handling : .... 12 Watts.
Flux Density : .... 16,000 Gauss.
BOTH UNITS have a frequency range of 40-15,000 c/s and impedance of 15 ohms.

GOODMANS

Australian Agent:

BRITISH MERCHANDISING PTY. LTD.
60 Clarence Street, Sydney. BX 1571

Please send High Fidelity Man
Name ....
Address ....
....
....
G100

crease bass before the organ be-at all apparent.

the most part, the quality other- clean, though just here and there verall signal level seemed to be g the system to its limits. The in-ntal work and orchestration is, it- a high standard for this class of tation.

uded are: "Hallelujah" (The Mes- 'Glory, Glory Hallelujah," "Three of Orient," "Christ The Lord Is "Bells Of St. Marys," "Halle- (The Robe), "A Mighty Fortress," David, Play," "Deck The Hall," Sunday" (The Robe), "The Lord's ," "23rd Psalm," (David and Bath- Chorale from "Finlandia."

* * *

JACKSON Sings Hymns and Spiri-al Songs, with Don Hustad and horale. Mono, GFM (Gospel Film linistry) 19-W3037-LP.

ne-time student of John Charles s, and backed with both operatic age training, Bill Jackson has a ue, baritone voice and an excep- sense of drama and presentation. new title is presented here in a nt and appropriate mood, adding a disc which could well be studied aspiring Gospel Singers.

light "hardness" on the voice is suspect, to the type of microphone nd is a quality I have commented ne or two earlier GFM discs. This econd-order criticism, however, as ould be mention of a slight sur-prickle" (as Julian Russell would

Titles: "Balm In Gilead," "Lily e Valley," "Lord I Want A Dia- "I Walk With The King," "Pre-Memories," "Follow Me," "Now I Belong To Jesus," "The Holy City," "I've A Longing In My Heart," "Sweet Little Jesus Boy" and "I'm Bound."

As an example of Gospel singing — recommended.

* * *

LET NOT YOUR HEART BE TROUBLED. Flo Price with the Paul Mickelson String Ensemble. Mono. GFM (Gospel Film Ministry) 33-W 3072-LP.

Gospel singer on U.S. radio and television stations, Flo Price has a smooth, pleasant voice and — on this disc — a simple style well suited to gospel hymns. If criticism is warranted at all, it would be that she tends, too often, to glide on to pitch in the slower numbers.

The Paul Mickelson ensemble, using organ, violin, celeste, harp, bass and guitar provide excellent and varied support.

All 12 hymns follow the theme of the title number "Let Not Your Heart Be Troubled." Others include "Yes, There Is Comfort," "God Understands," "Tenderly He Watches," "No One Understands Like Jesus," etc.

Technically the disc is excellent, notably for the "presence" achieved with the solo voice.

In short — very pleasant listening.

* * *

CROSSROADS OF LIFE, George Beverly Shea, produced by Darol Rice. Stereo, RCA. SL-101079.

Associated with choir and orchestra under Nathan Scott, George Beverly Shea adds yet another disc to his rapidly growing catalogue.

The title of the disc will probably mean less to Bev. Shea enthusiasts than the actual hymns, as follows: "The Wayside Cross," "He'll Carry You Through," "Lead Me Saviour," "Never Give Up," "In The Hour of Trial," "Let Jesus Come Into Your Heart," "Until Then," "In The Shadow Of His Wings," "Count Your Blessings," "Lead Me Gently Home," "Jesus Saviour Pilot Me," and "You May Have The Joy Bells."

The presentation follows the pattern and the standards set by earlier Bev. Shea discs while the quality of the disc, from the technical viewpoint, is likewise good. (Also available in mono.)

* * *

BELOVED HYMNS. Presented by Porter Heaps at the Pipe Organ of Radio Station WGN, Chicago. Mono. WG-B-1124.

According to the cover notes, Porter Heaps' engagements as a professional organist take him from work in a radio studio, and demonstrating organs, to playing in church services and with the Detroit Symphony Orchestra.

The instrument used on this occasion could be a "Wurlitzer" type played conservatively or it could be a more conventional pipe organ similarly augmented but, whatever the case, Porter Heaps handles it with modest facility.

In the two sides he presents 15 traditional Sankey hymns in leisurely tempo, seeking variation only in the organ voices. This is music strictly for those with conservative tastes in gospel music.

Technically, the quality is only fair. There is nothing gross that will offend the ear but hi fi enthusiasts will be aware of some hiss modulation on the original tape and, here and there, a vague uncertainty in pitch that would suggest a slight wander in recorder speed. Approached less critically, however, it could give considerable pleasure.

(Continued on Page 87)

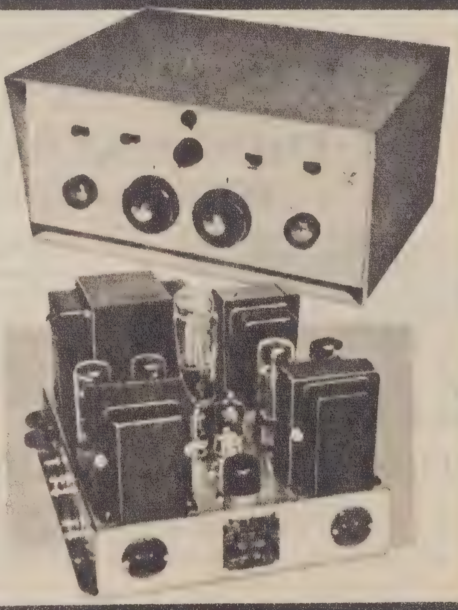
LOWTHER
STEREO CONTROL
UNIT AND AMPLIFIER

A non-compromise instrument, assembled by hand in England.

STEREO CONTROL
Each channel features two cascade triodes for first stage, giving high gain and low noise, followed by two triode amplifying stages, leading to cathode follower output. Every refinement of control, including independent bass and treble *for each channel*. Retail price £100.

STEREO AMPLIFIER
Each channel features fixed bias operated output stage for 15 watts continuous (British rating) into 16 ohms. Power output 15 watts fully maintained to 30 cycles. Frequency range 20 to 40k c.p.s. Output impedance below 0.75 ohms. Excellent square waves. Grain oriented transformers. Retail price £140.

MAKE A POINT OF HEARING A LOWTHER



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NEW *Releases!*

IN HI-FI TAPE RECORDERS

THE COMPLETE UNIT IS SUPPLIED IN ATTRACTIVE AND DURABLE TWO-TONE COVERED CASE COMPLETE WITH ACOS MICROPHONE AND FITTED WITH DUAL SPEAKERS.

The amplifier incorporates the latest "Mullard" tape recorder circuit equalised to C.C.R. standards giving perfect reproduction from recorded tapes. Outlet to power amplifier. Extension speaker outlet and "magic eye" level indicator. Amplifier is completely shielded and fitted with dress plate to match deck. Output: 4 watts can be used as straight amplifier if required.

Model TR3 incorporates the n Collaro "Studio" Deck whic features:–

- **Amplifier using six valves and rectifiers.**
- **Separate bass and treble controls.**
- **Monitoring facilities.**
- **High Fidelity. Frequency response 40 to 12,000 cycle 7½in per second.**
- **Three 4-pole shielded motors.**
- **Three speeds, 1-7/8, 3¾ and 7½.**
- **Fast forward and rewind, 1200ft in 65 seconds.**
- **Two track.**
- **Light piano key controls.**
- **PAUSE CONTROL**

This has the effect of stopping the transit of the tape past the "Re Playback" and "Erase" heads and applying the brakes to the spools leaving all switches and mechanical functions in their selected posi Typical application is to pause whilst recording to omit speech inter between musical selections. Control will only work whilst it is in position.

- **TAPE MEASURE AND CALIBRATING DEVICE**

The three digit counter makes the location of any recorded passage simplest of operations.

- **TRANSCRIPTION TECHNIQUE**

A large diameter flywheel with ground and lapped steel shaft running ball at the bottom of long bearing reduces friction and virtually elimi "wow" and flutter at less than 0.15 per cent at 7½in per second.

COMPLETE RECORDER WITH MIKE 69 GNS. f.o.r.

A COMPLETE HI-FI STEREO SYSTEM FOR ONLY 59 GNS. F.O.R

UNIT STEREO PLAYMASTER AMPLIFIER No. 2 WITH PLAYMASTER TUNER

—SPECIFICATIONS—

- **Output 7 watts per channel (14 watts).**
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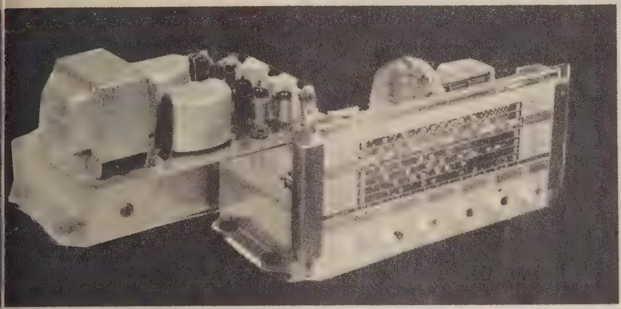

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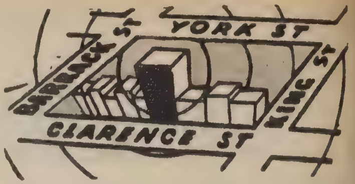

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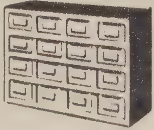

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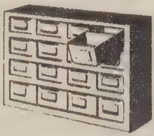

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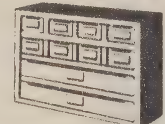

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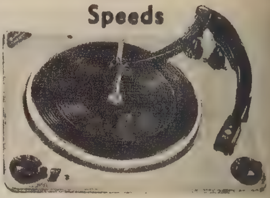

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loiting special lighting effects and l musical arrangements to high- their presentation, the 45 voice hoir is featured weekly in the Bay- ligious Hour and at weekends in churches.

bright indeed is their singing, full iety but always precise and well d.

titles — some medleys of well gospel hymns — include "Stand r Jesus," "The Face Of Jesus," God Of Wonders," "Oh What A "Love That Will Not Let Me Go," Paid It All," "Oh, For A Thou- Tongues," "Roll My Burdens " "Wonderful Love," "To God Be lory," "God Of Our Fathers," luyah, What A Saviour."

erms of quality, the disc is fairly an average but with rather more crackles than usual at the start one. But those with an interest oral arrangements of the light will be listening to the music, not rface pops.

N VARIED MOOD

ORCHESTRA — THE INSTRU- ENTS. Specially Commissioned tereo Recording, Shure/West- inster LS 661. Vienna State Opera rchestra Conducted by Franz aver-Theussal; Supervised by Dr urt List.

s is a test and demonstration ling with a difference — in fact l differences!

it it is a limited edition record is not available for general sale. ced by the Westminster Recording U.S.A., it is being used by Shure Inc., and their distributors to te sale of their current range of pickup heads.

such, all copies available locally essed and packaged in America.

preparing the recording, the ap- h has been to seat the orchestra in lassic Vienna pattern, arrange the phones for optimum two channel ling, then to tape and disc the without subsequent manipulation cial miking.

various classical excerpts have chosen to show the ability of rn stereo discs and pickups to cap- and isolate particular instruments led from their actual positions in rchestra—trombone, tuba, double trumpet, oboe, harp, etc. All ions were recorded especially for isc.

at is being attempted is explained y and with reasonable modesty in rinted notes. The listener is left to the success of the venture as heard sumably—on his newly acquired pickup.

edless to say, all this makes very sting listening and the disc is one any enthusiast would like to have collection.

quality and definition of the re- ng is generally excellent, though the e has enough stray crackles to pre- it from being described as com- y silent.

r further information on this disc to the advertisement on page 16.)

GOLDEN ORGAN FAVOURITES, Lenny Dee. Mono. Festival FL-30,106.

Here's a disc with a title which could be misleading, because these are hardly "Golden" organ solos. You'd be nearer the mark if you thought in terms of a handful of instrumentalists — including Lenny Dee in flippant mood.

To be sure the numbers all have recognisable titles, but what does a title matter when you really want to have fun with percussion and a Hammond organ? And Lenny Dee has fun, particularly in "Chico Chico."

Quality-wise, the disc sounded pretty right to me, though I suspect the organ speakers of audible protest at times at the complex combination of chords, tremulants and reverberation.

* * *

GREAT, GREAT, GREAT, Pat Boone with Billy Vaughn's Orchestra, Arrangements by Billy Vaughn, Milt Rogers, Ernie Hughes. Stereo, London. SAHA 7645.

With Pat Boone and Billy Vaughn in cahoots, it is inevitable that the result be bright, tuneful and expert in all departments. The disc itself is likewise well recorded, so if you're looking for some bright new pops—and aren't too square—this would be a good choice.

The title, by the way, is supposed to describe the "twelve terrific tunes" as follows: — "Stagger Lee," "El Paso," "Running Bear," "The Pillow You Dream On," "Cathy's Clown," "Wayward Wind," "Tweedle Dee," "Cherry Pink," "That'll Be The Day," "White Silver Sands," "Why Don't You Love Me," "Personality" and "The Whole World In His Hands."

* * *

FORTY-FIVE SONGS CHILDREN LOVE TO SING. Bob Hastings, Orchestra directed by Walter Fleischer; produced by Lyle Kenyon Engel. Mono, RCA Camden CAM-69.

With excerpts from well over forty songs on the two sides, it is quite inpractical to list the total contents of this disc. Sufficient to say that a large proportion of the tunes will be familiar to most children of primary school age.

The themes range from traditional to nautical and western; from Music Hall and square dance to a spot of Scotch, English, American; from animal ditties to lullabies.

With appropriate change of voice and accompaniment, television artist Bob Hastings strings them all together in a way that will entertain the children — and a good many parents as well.

The recording quality? Excellent!

* * *

THE SELECTED POEMS OF DAME MARY GILMORE. Read by Shulamita Rovkin. Mono, Rex RL300094.

The name of Dame Mary Gilmore is well known to every Australian but her actual writings may not be quite as familiar.

"Rex" make it possible to close the gap with this double-sided LP of Dame Mary's poems, prefaced by a personal interview recorded as recently as June 1961—in her 96th year.

The poems are spoken by Shulamita Rovkin, a young and talented actress attached to Australia's National Theatre.

Her diction is excellent and the disc would be eminently suitable for educational purposes.

Critical listeners will notice, however, some acoustic background noise and undue prominence of sibilants, which would indicate something other than an ideal recording locale.

* * *

CARMEN CAVALLARO Plays His Show Stoppers — Orchestra directed by Jack Pleis. Stereo, Festival SFL-930-143.

With his undoubted digital dexterity, and against a lush orchestral background, Carmen Cavallaro plays the numbers which he considers to be his own private "Show Stoppers." And, even though the well-known originals are often submerged in the "arrangements," there can be no doubt about the impact of the result, at a popular level.

The titles include "Chopin's Polonaise," "Begin The Beguine," "My Funny Valentine," "Rhumba Maria," "Warsaw Concerto," "Serenata," "Jalousie" and "Intermezzo."

With a faultless surface and nicely balanced, the disc makes good listening, except for a trace of fuzz in the most heavily modulated grooves.

* * *

HANSEL AND GRETEL, Engelbert Humperdinck, Orchestra conducted by Franz Allers. Mono, R.C.A. Camden CAM-68.

From the soundtrack of the film adaptation of Padraic Colum, this disc has all the atmosphere and drama necessary to ensure rapt attention from the younger generation. Whether the story is familiar is unimportant, an easy-to-read outline being on the cover notes.

The recording itself is extremely good. Against a full symphonic orchestral background, the voices stand out in sharp relief, while an excellent chorus is provided by the Apollo Boys' Choir. The children will like it—and so will you.

Recommended — especially at its economy price—for both content and quality.

* * *

THE WEAVERS AT HOME. Pete Seeger, Ronnie Gilbert, Lee Hays, Fred Hellerman, Erik Darling. Directed by Harold Leventhal. Mono, Vanguard VRS-9024.

Specialising in folk songs, the Weavers here present 17 songs, under the four subject titles: "This Land" — local America; "Goin' Places"— snippets from elsewhere; "Four Nights" — traditional and spiritual; "Awfully Sad Songs"—the brightest sad songs I've heard.

The idea of buying a full LP of relatively unfamiliar folk songs may or may not appeal to Australian listeners but, if it does, you need have no fear about the capabilities of the Weavers. Their vocal and instrumental work is at one time bright, spontaneous and precise.

The disc itself is likewise of a high standard—wide frequency response, low noise, modest overall level and never a sign of system overload.

* * *

ROBESON, With Chorus and Orchestra. Mono Verve MGV-4044.

Don't judge this record by the first number "Some Enchanted Evening," sung quite out of character in the lowest setting imaginable.

The remaining titles—fortunately—are better Robeson material, sung with commendable verve and intensity by the aging singer: "My Lindy Lou," "Sky Boat Song," "Riddle Song," "Down De Lover's Lane," "Land Of My Fathers," "I'll Walk Beside You," "Curly Headed Baby," "Trees," "Just A'Wearying For You," "Climbing Up The Mountain."

The recording? Excellent.

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.0056 x 600		6
.02 x 600		8
.022 x 1000	1	3
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N REVIEW—By JULIAN RUSSELL

ON GIOVANNI"—First Stereo Set

rt — Don Giovanni. Complete pera. Eberhard Waechter (Don iovanni); Joan Sutherland (Donna nna); Luigi Alva (Don Ottavio); ottlieb Frick (Commendatore); lisabeth Schwartzkopf (Donna Elira); Giuseppe Taddei (Leporello); iero Cappuccilli (Masetto); Graiella Sciutti (Zerlina). Philharnonia Orchestra and Chorus conlucted by Carlo Maria Giulini. olumbia Stereo SAXO2369/72.

s is the first stereo set of the opera put on the local market and is y of warm recommendation. It is ithout its faults, though a perfect Giovanni seems always just be- the limits of human achievement. wever, the point I wish to make t the faults in this set will prob- not be duplicated in others which nevitably appear, but which, too, have their own shortcomings. I nly hope that they are as incon- ble as those in the set under re-

e outstanding performance in the mbia comes from Elisabeth artzkopf as Donna Elvira. She has, ps, in other works, sung with more stent beauty of tone, though even there would be few sopranos to h her in this role.

t it is in her vocal characterisation she shines peerlessly above com- g stars.

e gets right into the skin of the and exploits every inspired line aracter delineation that Mozart has nto his miraculous score.

xt comes Gottlieb Frick as the Com- latore, his voice darkly menacing yet cavernous, a thoroughly convincing ation of retribution, one that always ins warmly musical despite its a. These two characters are built uch solid structures of flesh and d that the others tend — if one pts Giuseppe Taddei's admirable Le- llo—to withdraw themeselves a little ontrast.

most as if he feels this to be the as if he is aware that he is being shadowed, Eberhard Waechter in the role tends to strive a trifle too hard ake his points and sacrifices some e patrician qualities of the character , it must be remembered, is like pia in Tosca, fundamentally an aris- t, though a villainous one.

rangely, as has been noticed else- re, it is the servant, Leporello, who ars, in this version, to have a better ly background than the master. But uld stress that, with all his faults, chter is an eminently acceptable and that my criticism, as it must ys be when assessing a Mozart a, is directed toward hypercritical er than inexperienced listeners.

adame Sciutti's Zerlina is always oughly workmanlike and Luigi Alva rs an entirely enjoyable Don Ottavio.

e now come to what will probably the most controversial performance in the set—Joan Sutherland's Donna Anna.

For it must be faced that while Miss Sutherland sings the role like an angel —her cool, accurately pitched top notes provide a pleasure one is unlikely to find elsewhere for a long time—she has not yet developed the acting maturity to give her role its full weight. Her performance is ever so slightly too cerebral, too, too patently careful to avoid the many traps that lie in wait for the overambitious newcomer to the role.

That leaves for consideration the orchestral playing and the direction of the great ensembles under Giulini and for these I have nothing but the greatest praise. Both are superb and have the benefit of fine engineering to reproduce their many subtleties. And the climaxes of both the first and second acts are the most exciting I have ever heard recorded.

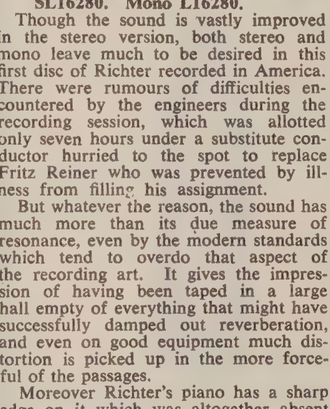
* * *

Brahms — Piano Concerto No. 2 in B Flat Major. Sviatoslav Richter and the Chicago Orchestra conducted by Erich Leinsdorf. R.C.A. Stereo SL16280. Mono L16280.

Though the sound is vastly improved in the stereo version, both stereo and mono leave much to be desired in this first disc of Richter recorded in America. There were rumours of difficulties encountered by the engineers during the recording session, which was allotted only seven hours under a substitute conductor hurried to the spot to replace Fritz Reiner who was prevented by illness from filling his assignment.

But whatever the reason, the sound has much more than its due measure of resonance, even by the modern standards which tend to overdo that aspect of the recording art. It gives the impression of having been taped in a large hall empty of everything that might have successfully damped out reverberation, and even on good equipment much distortion is picked up in the more forceful of the passages.

Moreover Richter's piano has a sharp edge on it which was altogether absent from his DGG discs. Add to that the fact that soloist and conductor do not always sound as if they have the same end in view and you have features which add up to an atmosphere of considerable disappointment. This becomes all the more keen when the perfection of Richter's previous recordings is remembered.



"You'll wake the baby!"

His playing here, though it has its marvellous moments, lacks the wonderfully sure sense of purpose one has come to expect from one who, in a comparatively short time, has built up a reputation as one of the world's greatest pianists. In only one movement does he seem quite at home, the Andante, in which every beautifully considered bar is a delight. And he has here, too, the support of a cello solo that, in my opinion, is peerless in its beauty.

The balance throughout is reasonably good, both internally and between soloist and orchestra. But with all the good will in the world towards a pianist who has given me so much pleasure in his previous recordings, I cannot recommend this version so long as Artur Rubinstein's is still available on R.C.A.

* * *

Beethoven — Piano Sonata in F Minor, Op. 57 (Appassionata); Piano Sonata in A Flat Major, Op. 26 (Funeral March). Sviatoslav Richter. R.C.A. Mono L16287.

The engineers, perhaps because of different circumstances, treated Richter much better in this disc. The piano tone is rounder and cuts off much more cleanly than in the concerto noticed above.

And Richter is right back in the form that has, till now, thrilled the most discriminating critics. True, the conventional will find tempos to question, though they will be hard pressed to contradict their validity in the context.

The gusty passion that constantly falls back upon itself in the first movement of the Appassionata, the simplicity of statement of the short slow movement which so effectively separates the stresses of the two outside movements, and a Finale which constantly threatens to run away yet remains always firmly under control in an amazing display of technical brilliance, all these add up to a performance that this listener found most moving — and logical.

And the modestly proportioned "Funeral March" Sonata makes a fitting companion to the fiery assertions of the stormy Appassionata.

* * *

Strauss (Richard)—Till Eulenspiegel; Don Juan; Dance of the Seven Veils. Philharmonia Orchestra conducted by Otto Klemperer. Columbia Stereo SAX2367. Mono 33CX1715.

The jester is an unusual role for Klemperer to fill, and he seems a little ill at ease when trying to impart a spirit of mischief to the irresponsible pranks of Till Eulenspiegel. Nobility, drive, majestic proportions are all expected from him, and seldom disappoint the most captious of his critics.

But in Till he is a little too staid. Strauss' orchestra cannot fail to chortle and chirp, but here it does so mirthlessly, though with unexceptionable rectitude.

Moreover, Klemperer's tempos, re-

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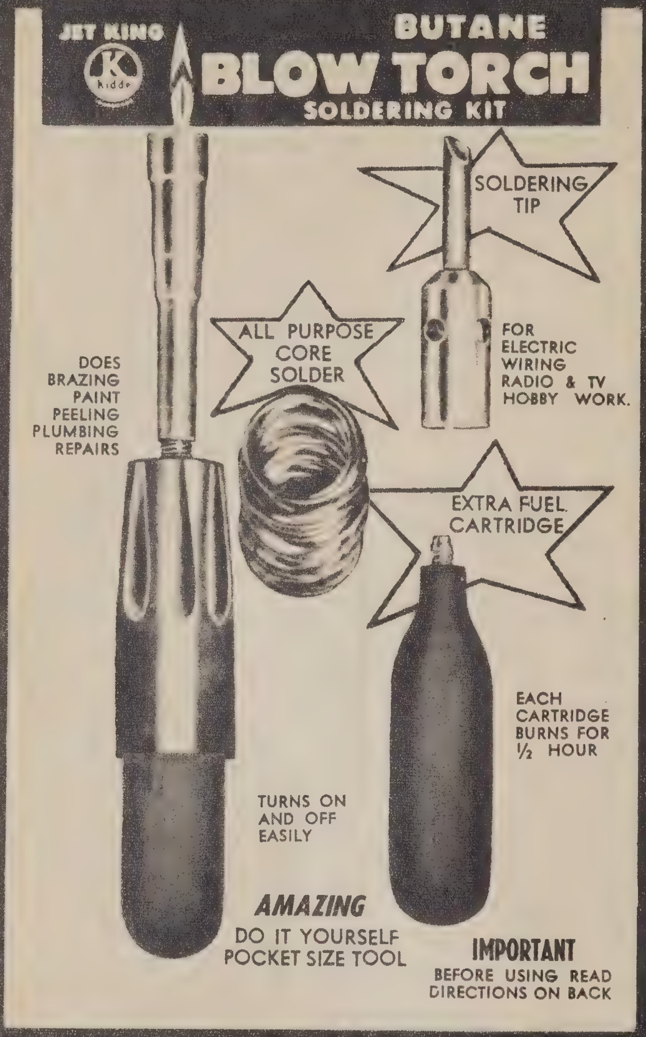
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ced considerably from what is custo-ry, do much to drain out Strauss' ht-hearted intentions from the bril-nt score. And it must not be for-tten that Strauss was a rare pheno-non—a German with both wit and mour.

In much the same way, Klemperer's on Juan has tremendous drive but ver quite achieves an atmosphere of petuosity. There is never a hint of inkmanship in his reading.

But where this performance shines far ore brightly than any of its competi-rs is in the brilliant balancing of the chestra which, allied to first-rate en-neering, reveals details of the score hich this listener has never heard be-re either on disc or in a concert.

And these are all produced without peding the extraordinary propulsion at seems to be Klemperer's very own cret. The occasional slight coarseness the brass tone reminds one of rauss' advice to a pupil, "Never look the brass, my boy. It only encour-es 'em."

Rather surprisingly, at any rate to this tener, the most successful of the three cerpts is the Salome "strip tease" — it has recently become known to the ppant. Klemperer makes the intro-ction sound very eastern indeed, with me quite wonderful pianissimos. And roughout this piece, too, some orches-al parts neglected or submerged into e general texture by other conductors ceive revealing attention without freak-h preponderance.

The whole piece is pulsingly sensuous d the orchestral tone of outstanding chness and clarity.

* * *

ıccini—Madam Butterfly. Complete Opera. Victoria de los Angeles (Madam Butterfly); Miriam Pirazzini (Suzuki); Silvia Bertona (Kate Pinkerton); Jussi Bjorling (Pinkerton); Mario Sereni (Sharpless); Piero de Palma (Goro); Arturo La Porta (Yamadori); Paolo Montasolo (The Bonze). Orchestra and Chorus of the Opera House, Rome, conducted by Gabriele Santini. HMV Stereo OASD 373/5. Mono OALP 1795/7.

Despite its many good points I find it fficult to recommend this set with eat enthusiasm. And this in the face of truly affecting performance of the title le by Victoria de los Angeles. She ters in the most beguiling manner aginable in the first act and goes on a love duet that trills with the purity its tone and expressiveness of phras-g.

And she is still better in her scene ith Sharpless in Act 2, especially in e almost conversational exchanges with at comforting character. But it is in e last act that she becomes pathetic ther than tragic, though she remains ndeniably moving even here.

It would be difficult to imagine a more ylish consort than Bjorling's Pinker-n, ardent and still conveying a sense youthful ardour despite traces of rain in the upper register of his fine nor voice. And Sereni's Sharpless is all at character should be—paternal, rewd, yet compassionate, and shocked finding himself involved in a situation bout which he warned Pinkerton in the pening bars of the opera.

Suzuki acts well vocally, but takes a ttle time to shed some unsteady throat-ess in her early scenes. My main dis-ppointment was in the conducting of Gabriele Santini. Despite insistence of a fine warm tone from his orchestra, he seems to have been satisfied to settle for a run-of-the-mill reading of the work which compares unfavourably with the bright freshness Leinsdorf shed on it in his admirable performance for RCA.

* * *

Chopin—14 Waltzes. Witol Malcuzynski. Columbia Stereo SAX2332.

I know of only one serious competitor to Malcuzyski's elegant presentation of these waltzes — Artur Rubinstein's. But the margin between the two is always slight.

Malcuzynski's sense of rhythm is firmly enough established to enable him to impose rubatos which never impede the natural progress of the music nor distort its graceful line. If he had exercised the same sensitivity of nuance in the dynamic inflections that he does in the changes of tempo, the performances would have been still more impressive.

An occasional digital awkwardness mars a bar here and there, notably in the fourth waltz. But generally speaking the articulation is commendably effortless, and, though the writer's preference still veers toward Rubinstein's R.C.A. disc, others may well disagree with him.

* * *

Werder—Fantasias in Three Parts. Glickman String Trio. Mozart—Oboe Quartet in F Major (K.370). Glickman String Trio with Jiri Tancibudek (oboe). W. and G. Mono. WG-A1114.

Melbourne composer Felix Werder first came to the writer's notice in W. and G.'s recording of a string quartet of his played by the MacDermott combination some three years ago. This was a work of considerable originality and power that might have been improved by some slight tightening of its rhetoric.

The new work is much more firmly knit and the composer has developed a sensitivity in handling fragile textures that was absent in the earlier work. I found all of it impressive and much of it moving.

At first hearing you may find it formidably dissonant, but familiarity will enable the average listener who knows

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way around the contemporary idiom ollow with rare pleasure the always cal development of Mr Werder's sparent polyphony—and polytonality. fuch of the composer's musical think- seems dominated by strong Jewish onal instincts, not the sentimentalised tillation of a Bruch, but the deeper, Testament forcefulness of an Ernest ch. Some of his themes have a strong ental flavour, but their development ws both originality and resource.

he extremely expert Glickman String pays full tribute to the composer's inous scoring, in which all the notes n to fall quite naturally under the yers' fingers. But such is the skill the Glickmans that this may be quite sory.

he Mozart offers what is, to me, the st accomplished performance ever re- ded in Australia. Jiri Tancibudek ys the oboe part as exquisitely as I've r heard it. His technique is faultless, tone rock-steady yet sensitively in- ted, and his phrasing aristocratic.

he Glickmans again play with a ish that puts them right up among world's best combinations of this d. W. and G. are to be warmly nked for their encouragement of such inguished local talent. The sound is t-rate judged against the best of mod- standards.

* * *

umann—Symphony No. 1 in B Flat Major, Op. 38 (Spring); Symphony No. 4 in D Minor, Op. 120. London Symphony Orchestra conducted by Josef Krips. Decca Stereo SXL2 223.

This is a most attractive disc, espe- lly for those who find their desire hear these delightful symphonies frus- ted by their almost complete absence m contemporary concert programs. ps maintains a perfect balance in his hestra which goes far to offset the msiness of much of the scoring—no an feat and one which depends as ch on the sound engineer's skill as conductor's.

The London Symphony Orchestra ys with superb elan and accuracy a fine feeling for the romantic ele- nts in the music. This, if one excepts Chicago Symphony under Reiner, is most improved orchestra recording lay. It is not long since they worked ir way through compositions with dull nestness. Nowadays, spiked by the dition of a fine group of first-desk oists, they come close to matching best two English orchestras — the yal Philharmonic and the Philhar- nia.

The sound is Decca's at its best — ich means that it is of a standard ely challenged by other labels. And symphonies themselves will delight those who do not pose as being sur- ted with nineteenth century romanti- m.

* * *

bussy—Iberia.

Ravel — Rapsodie Espagnole. La Valse.

Rochester Philharmonic Orchestra conducted by Theodore Bloomfield. Everst STELP-703 (Stereo). ELP1102 (Mono).

The sound in this is a little on the side but offers some compensation its formidable clarity. It is, indeed, skilfully etched that it suggests a se-up drawing of the score, with every te in its place but little in the way of ding to blend the lines.

Theodore Bloomfield's treatment of the music matches the engineering in clarity and hardness of outline. In Iberia the tempos are relentlessly strict in the first movement giving it almost a processional character. What shadows there are suggest the sharp-edged photographic blackness that might perhaps be found in Spain at noon, but which might have been softened a little in the cause of art.

The melting beauty of the slow movement with its exquisite oboe and cor anglais solos suffers from the same pursuit of clarity for clarity's sake. Its atmosphere is frosty rather than voluptuous.

Only the Finale comes close to the accepted manner of presenting this colourful work. Here you will find plenty of bustle and even a suggestion, admittedly slight, of gaiety.

The same treatment robs the Rapsodie Espagnole of much of its romantic appeal. It is seldom langourous, though always eminently correct, and creates much the same blueprint atmosphere as Iberia.

The only piece to achieve a truly sensuous quality of tone and expression is La Valse. This is superbly played and rises impressively to a beautifully prepared climax. A recording of this type, while it may not have any great appeal to those who desire to be charmed, should be invaluable to students following the music with an orchestral score.

Both versions are excellent, the mono filling in a quite extraordinary amount of detail though the stereo adds to this both transparency and spread.

* * *

Josquin des Pres—Missa Pange Lingua. Russell Oberlin; Charles Bressier; Gordon Myers; Brayton Lewis with Choir and Alto Shawm, Tenor Trombone and Small String Contrabass. Fanfare for Louis XII; Heth Sold Ein Meisiken; Fama Malum; La Bernadina; Si J'Ai Perdu Mon Ami. Some of the items for Voices, others for instrumental combinations, including Treble Cornetto, Shawms, Trombones and Small String Contrabass. Festival Stereo SEC-9330,062. Mono FC-30,062.

A new Noah Greenberg New York Pro Musica recording is now awaited with excitement by connoisseurs of the type of antique music that receives so much benefit from his wide scholarship. Even the most critical will not be disappointed with his most recent offering.

They will enjoy again the unusual pleasure of the tart timbres of ancient instruments and the general sense of dedication in all concerned with the production—singers, instrumentalists, and sound engineers. And they will enjoy, too, the grandeur of the mass, Missa Pange Lingua, for Josquin provided the summit of the music of his period, the approach to which took some 150 years to traverse.

The singers display none of the mincing phrasing and diction that, alas, too often accompanies reconstruction of performances of the past and might be best described as the "Morris Dance" school. Russell Oberlin is as accomplished as ever in the use of his delicious countertenor.

Contrasting the mass are the short instrumental pieces, full of spirit and inexhaustible in invention. The stereo version has a slight advantage over the mono in breadth and depth but the mono is surprisingly clear, well balanced, and luminously intoned.

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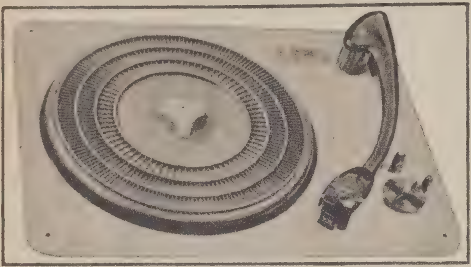

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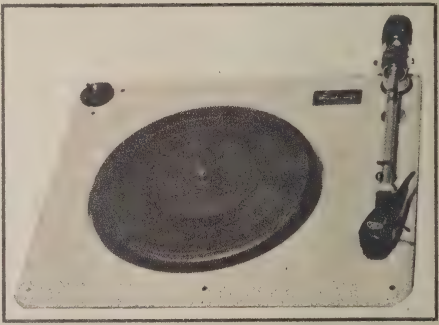

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DETAILS OF THE VK-ZL DX CONTEST

DX contests often provide the unusual in rare amateur stations from other parts of the world. Participants have an opportunity to extend their countries' tally and enjoy the operating practice such contests offer.

HE VK-ZL DX contest for 1961 will be conducted over the first and second weekends October (includes one day in September). The ational Societies, the NZART and the WIA, vite world-wide participation in this year's cont. Conditions, although on the wane should ovide plenty of interesting contacts.

The following is a summary of the rules for e contest:—DX stations will contact VK and L stations. Phone section—24 hours from 00 hours G.M.T., Saturday 30th September to 00 hours G.M.T., Sunday, 1st October.

CW Section—24 hours from 1,000 G.M.T., turday, 7th October to 1,000 G.M.T., Sunday, h October.

Duration of the contest for all contestants is hours.

There are three main sections in the contest, ansmitting phone, Transmitting CW and Reiving phone and CW.

Mobile Marine and other non land-based are t permitted to enter the contest.

All amateur frequency bands may be used but cross-band operating is permitted.

CW will be used for the second weekend and one for the first weekend. Stations entering th sections must submit separate logs.

Only one contact per band is permitted with y one station for contest purposes.

Only one licensed amateur is permitted to erate any one station under the owner's call n. Separate logs must be submitted if two more operate a station.

Cyphers: Before points can be claimed for contact, serial numbers must be exchanged and knowledged. These numbers are in accordance th standard procedure RS plus three figures r phone and RST plus three figures for CW. e figures indicate the number of the contact and crease by one for each successive contest QSO.

Scoring: VK and ZL stations: Five points for ch contact on a specific band. In addition, r each new country worked on that band, ONUS points on the following scale will be lded:—1st contact 50 points, 2nd contact 40 ints, 3rd contact 30 points, 4th contact 20 ints, 5th contact 10 points.

For this purpose the ARRL countries list will used with the exception that each call area the U.S.A. will count as a scoring area.

Logs: Must show date and time in G.M.T., ll sign of station contacted, band used, serial mber sent, serial number received, contact ints, bonus points. A separate log should be bmitted for EACH BAND.

A summary sheet must also be supplied showg call sign, Name and Address, the score aimed for each band and the total score, deils of transmitter, receiver, power, etc. A claration must be attached stating that operation as in accordance with the rules and spirit of e contest.

Receiving Section: Rules are the same as for e Transmitting Section and competition is open all members of any S.W.L. Society in the orld.

Logs will take the same form as for the ansmitting Section with the serial number reived omitted. Scoring will be on the same asis. It is not sufficient to log a CQ.

VK receiving stations may log overseas stations d ZL stations, while ZL stations may log overeas and VK stations.

The WIA will award certificates to the top orer on each band and the top scorer in each K and ZL District.

Entries must be postmarked not later than one onth after the close of the contest and addressed WIA Federal Contest Committee, G.P.O., Box 51J, Hobart, Tasmania.

ATTENDANCE AT MEETINGS

ATTENDANCES at meetings have been a matter of concern to many WIA officials in recent ears. There has been a general falling off in tendances despite some very attractive lectures eing offered in many cases. The large attenances of the early post-war years are ot being repeated, despite an increase in e amateur population. In N.S.W., for instance, tendances were often up to 130 persons and onsistent above the 100 mark at that time.

Many factors are contributing to the drop and now takes a very special event to attract a ood attendance especially during the winter onths. A number of these factors are as folws:—

In recent years WIA activity has become of ecessity sectionalised. WUL, VHF, SWL, etc. roups holding meetings, there is a limit to the number of times the OM is allowed out. TV has attracted a number from the ranks and the increasing average age of amateurs, despite the newcomers, keeps some of the OT's at home.

Such falling off in attendances is not only common to this country; the RSGB Bulletin even carries an editorial on the subject. Their meetings held in London often do not attract more than 40 members, despite a potential of some 2,000 members located around the London area. Attendances have dropped from above the 100 mark.

The unfortunate aspect of the whole subject is that the attendances recorded do not provide much encouragement to the officials of the WIA in their endeavours to push the cause of the Amateur Radio Service. Members should make every effort to attend general meetings in support of the WIA's welfare.

LECTURES GIVEN

LECTURES for July delivered to sections of the W.I.A., N.S.W. Division, included H. Crisp, VK2LX's discourse to the Central Coast Section on his recent trip to Japan. Vol Molesworth, VK2VO, provided two lectures; both covered the wrecking of disposals gear and were presented to the Hunter Branch and the S.W.L. section in Sydney. The mid-month Divisional meeting held at Administration H.Q. was the occasion for a recorded tape lecture made by Joe Reed, VK2JR, on HF direction finding covering all phases of this work.

Mr Paul Free, of S.T.C., was the lecturer at the month's general meeting held at Science House. The subject was "Silicon Rectifiers" and the lecturer provided valuable information on the performance and operation of these miniature components. Those attending were told of the things not to do when using these rectifiers, no screwdrivers for checking HT and no overloading, as is often the case with amateur equipment. It was a lecture greatly appreciated by members attending.

Twenty-three new nominations for membership were endorsed at the meeting.

The meeting also endorsed the Council's decision to proceed with the new building for lecture hall and disposals store facilities at Administration Headquarters at Crow's Nest. The building will cost in the vicinity of £8,000 and three-quarters of the money required is in hand. A firm price has been received and all formalities have been completed. The building will be a valuable asset for the division.

MOBILE RALLY

THE weather was very unpleasant for the N.S.W. Divisions Mobile Rally, held on Sunday, July 23rd, which finished at the VK2WI Dural grounds. Despite the wet weather, many mobile stations participated and at Dural a unit of the 1st Divisional Signals Regiment provided a display of Army Signals equipment.

AMATEUR HEADS "MIDAS" PROJECT

Successful girdling of the globe by the American "Midas" satellite represented achievement of what must be the dream of every amateur radio operator in the world—communicating with an object in outer space. Significantly, the man behind the Midas is a one-time amateur operator who realised this dream.

HE is Joseph J. Knopow. Officially he is manager of the Midas systems for Lockheed's vast missiles and space company in Sunnyvale, California.

Knopow is responsible, under over-all U.S. Air Force management, for the technical direction, guidance and co-ordination of what may well be one of the most important space programs of the generation. (Midas draws its name from MIssile Defense Alarm System).

The Midas program calls for the orbiting of modified Lockheed-Agena satellites capable of detecting intercontinental ballistic missiles as they are launched. The objective: to provide the earliest possible warning of missile attack.

A modest man, Knopow initially proposed the Midas concept, and has continued to occupy a key position in the program. Lockheed executives close to the program declare that Knopow's work will represent a major factor in the ultimate success or failure of the important space effort.

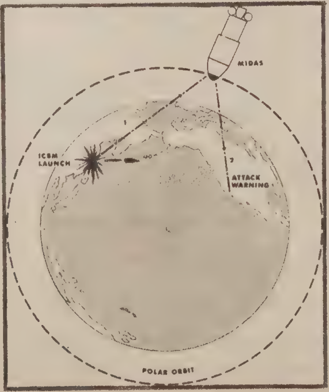
Knopow is one of the free world's most creative electronic specialists. He was off to a running start while still in grammar school, 35 years ago. Then he built an amateur radio station licensed as W9KA. Knopow was still in knee pants.

A few years later as a licensed commercial professional, he was working his way through the University of Wisconsin tending the tubes and transformers of a State broadcasting station.

Several science degrees later he moved directly to the forefront of the new world of electronics. He looks back now on 24 years of work with radar and infra-red equipment, nuclear weapons and anti-submarine warfare systems, TV and FM, microwave and radiology.

He supervised study and experimental investigation of nuclear weapons' effects during the "Operation Greenhouse" (atom-bomb tests in the Pacific). He participated in investigations and field tests of special anti-submarine warfare detection systems.

In 1955, when he went to Lockheed, he was ready for the dawning space age. As staff scientist at the Lockheed lab., he at once set about designing a reconnaissance system for the payload sections of the satellites—then merely marks on drawing boards—which were later to become the famed Agena family.



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Stations were in the field during the morning and the winners of the various scrambles were as follows: VHF, 1st; VK2ZCF, 18 contacts, 24 points. VHF and HF, 1st, VK2ASZ, 17 contacts, 39 points. HF, dead-heat for 1st place, VK2ASZ and VK2AMA, 32 contacts, 52 points.

The evening Fox Hunt of N.S.W. VHF and TV Section for July saw Fox Paul, VK2ZPJ, lose himself very successfully. After over one hour and a half the hounds were still wandering more or less aimlessly and it was then decided to call the hunt off and talk the various competitors in. With the gear out of the car and the antenna up the proverbial gum tree it was all very confusing for the hounds.

HUNTER BRANCH

MOST of the arrangements for the Hunter Branch's Annual Dinner and Field Day are complete. One of the most popular events on the amateur radio calendar in N.S.W., it will be held over the Six-hour Day holiday weekend (September 30 and October 1). This year the dinner will be held at the Esplanade Hotel, Newcastle, on the Saturday evening, while the field day will be conducted at the usual venue. The branch offered a special prize for ideas for their field event. Most similar days run to a set pattern and the branch was anxious to incorporate some new events.

Inquiries re the dinner and field day should be directed to the branch's secretary, Gordon Sutherland, 15 Marine View, Newcastle.

Guest speaker for the dinner is "Radio, TV and Hobbies" editor, Neville Williams, VK2XV.

SOUTH-WEST ZONE

AT a meeting at Wagga late in July the South-western Zone decided to hold their ninth annual convention later in the year at Tumbarumba. The program will be in the hands of the Tumbarumba Radio Club, who will organise the event. It was with regret the resignation of zone officer Jim Edge, VK2AJO, was received after nine years' service. Jim's successor is Bill Mills, VK2AHV.

TAPED LECTURES

THE N.S.W. Division's Technical Lecture Tape service is becoming very popular and demands for tapes from W.I.A. sections and radio clubs are increasing. One inquiry has been received from New Zealand. Tapes cover a wide range of subjects from S.S.B. to quads and come complete with circuit diagrams and graphs to illustrate the text. Harold Burtoft, VK2AAH, as Educational Officer of the Division, co-ordinates the scheme. Information regarding the service can be obtained from the Division Secretary, 14 Atcheson Street, Crow's Nest, N.S.W.

OT'S RETIRE

IN recent weeks two N.S.W., W.I.A. stalwarts for many years retired from active participation in divisional affairs. They were Dave Duff, VK2EO, and Norm Beard, VK2ALJ, both past secretaries of the division. Dave also a past president was an office-bearer over many years and in recent times has perhaps been best-known for his prodigious efforts on the technical side of the VK2WI Dural Project. It was mainly due to his endeavours that such a wide range of frequencies are covered by VK2WI transmitters and the simultaneous signals on three bands are received throughout the State.

Norm besides his duties as secretary performed much work on behalf of the Disposals Committee. He was responsible too for the inauguration of the division's A.O.C.P. correspondence course. Both will be missed for their work on behalf of their fellow amateurs. Keith Jeffcoat, VK2BK, is the new member of the Disposals Committee replacing VK2ALJ, while George Bruce VK2GT takes over the operation in the Federal W.I.A. traffic net from VK2EO.

Cec Bardwell, VK2IR, takes over full responsibilities for all A.O.C.P. classes and is now supervisor, replacing VK2ALJ. The N.S.W. division is considering the conducting of an A.O.C.P. refresher course to be run over 12 weeks. It would provide members with reasonable technical qualifications to brush up on theory allied to A.O.C.P. requirements without having to complete the full course before sitting for the examination.

OPERATING AWARD

THE new operating award announced by the Editors of C.Q. Magazine is one of interest to all amateurs both in the U.S. and overseas. It is the "United States of America Countries Award" (U.S.A.-C.A.) and the ultimate is to contact stations in all counties, just 3077 of them. There are seven classes of the award available—U.S.A.-500, contact with 500 different counties; U.S.A.-1000, contact with 1000 different countries; 25 different States must be represented; U.S.A.-1,500 contact with 1,500 different counties, 45 different States being represented, and U.S.A.-2000, U.S.A.-2500, U.S.A.-3000, al with 50 States represented and U.S.A.-3,077-C.A., the final award.

Q.S.L. cards as confirmation will not be required. Certification, however, by two other amateurs, to the effect that the cards are in the possession of the applicant will be necessary. C.Q. reserves the right to ask for sample Q.S.L.'s.

It is anticipated that expeditions to rare countries will become popular, an operation that should cost little time or money.

C.Q. will make available a record book to facilitate log keeping. This will show individual State maps and county outlines.

Many operating hours will be spent on this award — more than for any other operating award.

Clif Evans, K6BX, has been chosen as custodian for the U.S.A.-C.A. — he is renowned for his Directory of Certificates.

SUN-SPOT CYCLES

THE prognostications of experts on the future of sun-spot cycles during the remainder of this century makes dismal reading. George Jacobs, W3ASK and Stanley Leinwall in two articles in C.Q. provide an interesting insight into the sun-spot story, cycle 19 (the present cycle) and the decline in the years ahead. The two post-war maximum sun-spot numbers were for cycle 18-152 in 1947 and for cycle 19-201 in 1958. The predictions for cycle 20 show a peak in 1970 and an estimated maximum sun-spot numbers of 45 to 65, worse conditions than we are enjoying now.

Dr S. G. Lutz of Hughes Research Laboratories has published a long range solar cycle prediction based on his observations that cycle peaks seem to behave according to a long-term saw-tooth pattern. In accordance with his approach the new three sun-spot cycles (20, 21 and 22) should be low cycles with smooth sun-spot numbers not expected to exceed a value greater than 75 during the remainder of the present century.

To the D.X. minded it is very disturbing and it appears that some other generation will enjoy a repeat of the bonanzas of 1947 and 1958, Q.R.M., T.I.U. conferences, etc., permitting.

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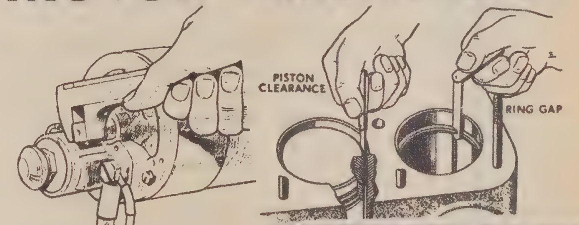

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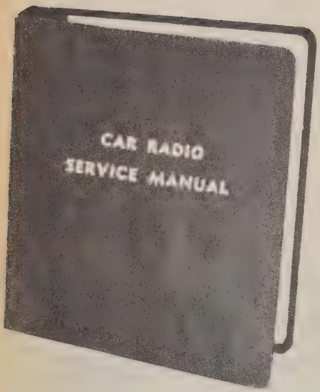

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144Mc. BAND

HE Band Operational Plan for 144 mc/s (144-146 mc/s) that has been in use in the U.K. r some years, has proved valuable but ideas a change have been discussed.

Under that scheme amateurs were grouped geo- aphically and each area listed to use a cer- in segment of the band. The arrangement per- itted groups when tuning specific frequencies to int their beams in the correct direction and know where to tune for the more distant ations.

The self-discipline of the 144 Mc/s band gang is been excellent in preserving the plan's re- irements in its present form and it proved its lue under Dx conditions. There is, however, w a tendency amongst operators to use net eration on the band and with this method in gue it is proposed to set aside certain fre- encies for such working. It is without a ubt, the most effective form of telephony oper- ion and a change from the normal call and ne system. Quite a number of stations are ing VFO control.

The net frequencies will be allocated for cer- in areas and will be positioned in the high equency end of the band. A large number of Mc/s Crystals are available from Surplus ores on spot frequencies and the nets are be located on harmonics of these Crystals. Net eration has come to stay on 144 Mc/s in the K., and changes of planning were considered ecessary.

RTTY operation is being carried out on 144 c/s in that country with a contact at 60 miles w being the best Dx recorded.

AMATEUR PASSES

T is with regret the passing of Jack Lindsay, VK2AKR, in July, was recorded. Jack was n enthusiastic amateur over many years, but in cent times had not enjoyed the best of health. e was one of the first VKs to erect a three- ement Yagi for the 14 Mc/s bands and provid- d one of the outstanding signals from this coun- y to Dx locations. The tower and beam loca- d at his QTH, north of Lidcombe station, was landmark that could be seen for miles around.

Jack was a keen experimenter and spent much me on 28 Mc/s during the Dx peak of the nspot cycle maxima of the late 1940s. In ter years he directed his activities toward mo- ile and portable operation on 7 Mc/s. Jack ill be sadly missed from the amateur ranks, nd sympathy is extended to his family on their ss.

BEACON STATION

THE RSGB's Beacon Station operating on 144.5 Mc/s with the antenna located on the B.B.C. wer at Wrotham, provides a continuous sig- al at that frequency. It is of great value to mateurs wishing to line up receiving equipment roviding a constant signal over a good range. ignals are recorded over a 86-mile path well ut of line of sight on automatic equipment and me interesting information on band propaga- ion has been noted. It has been found that e signal varies from a minimum of 0.5 micro- olts to a maximum above 20 microvolts. Other oints noted include the fact that signals vary t times from low to high levels over periods of 0 minutes or so. Secondly that maximum sig- als occur for longest periods during the even- ngs and again especially between 0600 and 900 hours local time. The recorded graphs ere displayed at the VHF/UHF seventh Inter- ational Convention held in London during May.

STATION AFLOAT

6W8CB/MM is the call sign of the Danae II, 27-foot yacht, now on a world trip that will st three to four years. The transmitter runs 0 watts and the receiver is a BC312. The tation will be heard on AM on all bands. The acht has travelled through the West Indies and ill enter the Pacific via the Panama Canal. n attractive QSL card is available for contacts, ards should be directed via K0GZN.

LOCAL CONTACTS

N view of the falling of the sunspot number (currently around 70) and to relieve the con- estion on 3.5 and 7 Mc/s with improving Dx onditions, publicity is being given to the virtues f 28 Mc/s for local contacts. The 1700 Kc/s vailable on that band provides plenty of space or such work. A simple transmitter and an- enna will do the job and with this point in view, verseas journals are plugging the use of 28 Mc/s.

FOX HUNTS

RADIO Fox Hunts in Europe are extremely popular and many amateur radio societies onduct events on a country-wide basis. Early n August the first of these on a continent-wide cale will be run by the SSA, the Swedish Nat- onal Society, it is called the European Fox Hunt hampionship. The event will be restricted to wo bands 3.5 and 144 Mc/s. Many of the uropean Hunts are conducted on foot as well s being a good DF-er you want to be in fair ondition.

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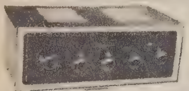

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7 WATTS PER CHANNEL. Dual Push Pull, Ultra Linear Output
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Speakers to suit from £3/-/- per pair. Cabinet chassis, front panel and anodised plate only £4/5/-.

DUO-PHONE 10 x 10 STEREO AMPLIFIER

10 watts per channel.
Valves 4.6BQ5. 2.7199. 4.EF86.
High Quality Transformers.
Input for Stereo. Gram. Mike. Tape. Monaural. Radio.
3-Speaker Output.
Kit Set .. .. £49/10/-.
Wired and Tested £56/10/-.
Also with built-in DUAL WAVE TUNER. Including R.F. STAGE.
£66

Battery Chargers

To charge 6 and 12-volt, 3 amp. £5/15/-
6 and 12v, 4 amp.
£6/15/-
Other Ratings To Order.

25 watt, 8 valve, P.A. 240 V.A.C. AMPLIFIER

Input for crystal mike. P.U. or radio with mixing facilities and tone control. High quality O.P. transformer for multi match O.P.

£23/17/6

Send for full details on Radiogram Chassis, TV and Amplifiers.

GUITAR AMPLIFIER

17 Watt! 4 Input Channels. Bass and Treble Boost.
2 Twin Cone Hi-Fi Speakers.
£36/17/6

TV SWEEP GENERATOR

2 Band. on Fundamentals.
5 to 6 megs.
28 to 40 megs.
Sweep Bandwidth to 12 megs.
Tuner Frequencies on Harmonics.
Prodis Sweep Unit.

£37-10-0

STEREOGRAM CHASSIS

Dual Wave with RF Stage.

8 VALVE, 6BA6, 6AN7, 6N8, EM80, 12AT7, 6BM8, 6BM8 5Y3.
2 Rola 8MX Speakers.
£38/15/-

10 VALVE, 6BA6, 6AN7, 6N8, 12AT7, EM80, 2 x EF86, 2 x EL84, 5V4.
2 Rola 8MX Speakers.
£49/15/-

15 VALVE, 2 x 6BA6, 6AN7, 6AV6, 6BR5, 2 x EF86, 12AT7, 2 x 12AX7, 4 x EL84, 5AS4.
4 Jensen Speakers.
£66/15/-

R. TV & H TV KITSET AS DESCRIBED IN THIS ISSUE

23in ----------	£99
21in ----------	£93

Wired and Tested. £12 extra.

MINIATURE P.A. AMPLIFIER

15 Watt output extended frequency Ferguson Multimatch Voice Coil. O.P. transformer inputs for crystal mike and pickup with separate mixing gain controls. P.P. EL84 — 6BQ5 output fitted with accessory socket.
Dimensions 12in x 8in x 4½in. fitted in Playmaster 2 Cabinet.

£17/15/-
240V A.C. operation.
240V A.C. and 12V D.C.
£22/17/6

AMPLIFIERS

Public Address Range
240v-AC

6 Valve, 10 watt,	£14/17/6
6 Valve, 25 watt,	£25/17/6
6 Valve, 40 watt,	£32/7/6
7 Valve, 20 watt,	£22/17/6
6-valve, 50 watt	£34/17/6
100-watt	£63

Battery Operation

6 valve 6v, 10 w	£18/15/
7 valve, 12v. 12 watt,	£19/15/
7 valve, 12v. 25 watt,	£24/17/6

BATTERY-AC OPERATION

6 valve 6 x 240 10 watt,	£20/15/-.
7 valve 12 x 240 12 watt	£21/15/-.
7 valve 12 x 240 25 watt,	£29/7/6.

TV ANTENNAE

A Complete Range from
£4/15/-

TAPE DECKS

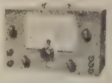
B.S.R. Monardeck
Twin Track 3¾in as used in R. TV and H. Tape Recorder a very efficient and reliable unit. With excellent performance.
£21

English 3 speed Twin Track Push Button Unit with counter position locator. Recommended for Mullard circuit.
£27/17/6

MOTEK ROBUK RK3

Latest English 3-speed Twin Track Deck. Push-button. 3 motor unit. Position Indicator. Superimposing Facilities.
£27-17-6

Chassis and Cabinets available for above Units.



LEADER SIGNAL GENERATOR L.S.G. 10

240V A.C. Power.
6 Band, 1 p.c. Accuracy.
120 KC to 270 Megs.
£15/10/-

L.S.G. 11

As above. Range to 390 Meg.
Provision For Crystal.
An ideal TV Marker Generator.
£19/15/-
Post. N.S.W. 7/6; Interstate, 10/.

LEADER LSG.531
SWEEP & MARKER GENERATOR £72

Including Tax
240v. A.C. POWERED 2 to 270 Meg

K 20

K 20

MULTIMETER

20,000 O.P.V. sensitivity.
Ranges:
DC volts, 0, 10, 50, 250, 500, 1000.
AC volts, 0, 10, 50, 250, 500. 1000.
DC current 0.50uA, 0.25, 0.500mA.
Resistance, 0.50K, 0.05 meg, 0.5 meg.
D.B. minus 20 to plus 36.
£7/19/6

K50. 50,000 O.P.V.
Ideal TV Test Unit.
Current Range to 10 Amp.
£19/10/-

MODEL K.2

2000 O.P.V. Sensitivity:
Ranges as above except 50uA.
£5/12/6
Post, N.S.W., 3/6; Int., 5/6.

MODEL K.4

4000 O.P.V. Miniature.
£4/15/-
Post. 3/6.

LATEST 4-SPEED PLAYERS

240 A.C. Monaural	£7	5	0
240 A.C. Stereo	£9	5	0
Battery Monaural	£9	5	0
Battery Stereo	£11	10	0

Post. N.S.W. 7/6; Interstate. 12/6.

New Transporta 7

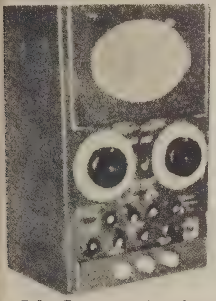
With R.F. Stage. 1 Watt Audio.
Using drift type transistors.
Improved range and performance.
KITSET £25/17/6
WIRED and TESTED,
£28/7/6.

A.C.E. RADIO

Amplification
Communication
Electronics

PHONE LA 3845

136 VICTORIA R'D. MARRICKVILLE, SYDNEY, N·S·W
AND 636 KING STREET, NEWTOWN — LA7008
EVENINGS and WEEKENDS: "KALUA," Hilma Street, Collaroy Plateau, XW5956
DULWICH HILL, UNDERCLIFFE, EARLWOOD BUS AT DOOR, STOP No. 42



AR8 Communications Receivers

12 valve. Converted to 240v A.C. Thoroughly Tested. Re-aligned. Latest Ovaltone Permag Speaker

£34/17/6

NEW VALVES

832A	19/6	VR75/30	15/
D21	£4/17/6	RK48A	£3
12C8	12/6	954	7/6
VT501	12/6	VR105/30	15/
1C6	12/6	6AC7	5/
1J6	12/6	EL3NG	12/6
3B7	10/	2X2-879	5/
3D6	10/	6AJ5	9/6
304TH	£1/10/	VR150/30	15/
2050	£1	6AK5	17/6
6AM6	17/6	9006	5/
1K7	5/-	6AS7	12/6
1M5	5/	CK1013	15/
6J5	9/6	6SL7	15/
6J6	15/	EF39	12/6
6J7G	7/6	EK32	15/
6N7	10/	EBC33	12/6
KTW62/6U7	7/6	809	9/6
1D5	7/6	100TH	19/6
6F6	12/6	6AG5	9/6
EF37	12/6	7F7	12/6
6X5	10/	EL91	10/
12K8	12/6	EF73	10/
1T4	10/	EF72	10/
1P5	7/6	EC70	10/
6AG7	15/	2A3	10/
VT502	12/6	807	9/6
1L4	5/	2C26	7/6
6K6	7/6	RK34	7/6
AV11	3/9	1N5	7/6
6K7	5/	1C7	2/6
12SJ7	12/6	1Q5	5/
12SL7	12/6	1M5	5/
6SH7	7/6	7C5	12/6
47	12/6	7W7	7/6
843	£1/10/	12A6	5/-
1625	£1	6J8	17/6
5R4GY	£1/5/-	6C8	7/6
1629	10/	VR65	5/-
1619	£1	12AT7	10/-
RK75	10/	808	17/6
		12SK7	7/6

GENEMOTOR OF MANY USES

May be used as—by Reconnection

1. GENEMOTOR, 220v, 110mA.
2. GENERATOR 6v, 12v 18v, 12 amp.
3. A.C. 1/6-h.p. MOTOR.

£1/7/6

NEW C.R.O. TUBES

3API-906	£1/7/6
5BPI	£1/17/6
CV1957	9/6
CV112	10/
VCR138	17/6
VCR97	10/-
5FP7	17/6
CV322	7/6
VCR511B	£1/7/6

NEW POWER TRANSFORMERS

240v A.C. 50 cycle primaries. Standard 6.3 filaments.

300 x 300v 40mA	19/6
1960 5" CRO	£5/10/
1960 3" CRO	£3/15/
325 x 325v 150mA	£3/17/6
250 x 250v 180mA	£3/17/6
295 x 295 300mA TV	£6/15/
1200 x 1200v, 500mA	£10/10/
550 x 550 250mA	£3/15/
800v and 270v. 300 mA, ea.	£7/10/
10v 5 amp	£1/10/
240v-110v. 1.3 Kv. Auto	£10/10/
150 x 150V 30mA	£1 5 0
225 x 225V 40mA	£1 7 6
124V Doubler 300mA	£2 10 0
130V Doubler 400mA	£2 15 0

Vibrator Power Transformers

6V 300V 125mA	£3 17 6
12V 325V 125mA	£3 17 6

Inverter Transformers

6V 240V 40 Watt	£3 7 6
12V 240V 60 Watt	£3 7 6
32V 240V 60 Watt	£3 7 6
12V 240V 100 Watt	£4 5 0
32V 240V 100 Watt	£4 5 0

RELAYS

6V. 3-pole Miniature	15/
1700 SPDT	7/6
1300 SPDT	7/6
500 x 500 SPDT	7/6
12 volts DPDT, 5 amp	£1
12 volts DPDT	12/6
100pf TX var. condensers	10/
100 to 500pf 3000v. var.	10/
500 to 2500pf 750v. var.	10/
Hi-speed Polarised relay	£2/10/
400 ohm	12/6
6V Type 3000 DP, DT	7/6

Hi-lo Phono Transformers	4/6
Hi-voltage. Lead-thru Insulators each: 15/ doz.	1/6
Multi-strand 4-core Cable. yard	1/
60pf with Vernier	£1/1/
30 pf	10/
Throat mikes. new	3/6

OIL FILLED CONDENSERS

.5mfd 600V	3/6
2mfd 600V	6/6
1mfd 600V	6/6
4mfd 600V	6/6
4mfd 2.5K	£1/10/
2mfd 2K	15/
.5mfd 5K .1 5K. .1 3K AC .25 4K .5 2½K	15/ ea.

COLLINS ART. 13

GENEMOTORS

28V 1M 750V + 1150V. 400mA. Out.

£10/10/-

GENEMOTORS

Input	Output			
12v.	600v.	300mA	New	£5 10 0
24v.	250v.	100mA		£1 0 0
24v.	550v.	375mA		£2 0 0
24v.	250v.	60mA		£1 5 0
12v.	500v.	350mA		£8 10 0
12v.	1200v.	200mA		£6 10 0
24v.	250v.	100mA.	New	£2 0 0
12v.	235v.	50mA		£2 15 0
12v.	350v.	50mA		£2 15 0
24v.	540v.	200mA	New	£2 15 0
24v.	300v.	250mA	New	£2 15 0
12v.	275v.	110mA		£3 15 0
12v.	300v.	250mA	New	£2/15/

NEW HEADPHONES

Low Impedance.

American Lightweight	12/6
Australian DLR	12/6
USED	
Tested DLR or CLR	9/6
Dynamic	17/6
Single. New Earpieces	2/

Post 2/6 Pair.

New Coils and Intermediates

Standard or miniature to suit all valves

Coils B/C, 455 KC	9/6
Coils S/W, 455 KC	9/6
Inters	11/6
Slug tuned H.F. coils to suit 44 meg.	4/6

VIBRATOR POWER SUPPLY

NEW AMERICAN NATIONAL.
6 Volt Units. 200V Out.
Fully Filtered. 40mA.

£3/15/-

WANTED

Communications Receivers. Test equipment. P.A. Gear. Large or Small surplus stock. Best prices. Call, write or phone any time.

ELECTRIC CLOCK MOVEMENTS

240v AC. Tested. Perfect order.

19/6

Post. 2/6.

GENEMOTOR SPECIAL

28 to 32v in. 300v, 250mA out. Operate TV from 32v.

Used £1/7/6, New £2/15/-

NEW 807 VALVES

9/6 Each

Post 2/.

NEW INDICATOR UNITS

For THAT C.R.O.
10 valve, VCR97, 6in Tube with mumetal shield and socket. In Cabinet.

£7/15/-

ELECTRIC PUMPS

New 400 G.P.H. 24V Aircraft Pumps Will operate from 12V.

£4/12/6

NEW ROTARY CONVERTERS

160 watt. 50 Cycle.
24v to 32v input.
Output can be supplied for 50-110 or 240v as required.
Suit radiograms, TV, tape recorders, fluorescent lights.

£19/17/6

COMMUNICATIONS RECEIVERS

American, National, H.R.O. Air Tested, Perfect Order. 6 Coil Boxes to 30 Megs. Crystal Gate, S. Meter, 2 R.F., 2 L.F. 240V AC.

£75

AMR 101

A.W.A. Version of Above Set. Similar Circuit and Facilities to 25 Megs.

£65

NEW MARCONI C100

6 Band 40 Kc to 30 megs. 10 valve, 2 RF 2.IF stage. 240 A.C. Fully Band spread. Air Tested.

£65

AR7 RECEIVERS

Completely Serviced. Re-aligned. PERFECT ORDER.

£57/10/-

Coil and Transformer Winders

MACRA PRODUCTION MACHINES including Dereeler, Counter, Clutch, ¼ h.p. Motor, Tensioner, etc. Ex P.M.G. Dept.

£15

522 TRANSCEIVERS

Complete with Valves. Excellent Condition.

£8/17/6

522 Receivers. Complete with Valves	£5/17/6
522 Transmitters. Complete with Valves	£4/17/6

P.A. SPEAKERS

New Dynaphon P.A. Units. Double ended with short reflex horns.

£12/10/-

American R.C.A. 20 Watt P.A. Speakers. Used. Tested. Perfect order.

£10/10/-

CARBON MICROPHONES

Respirator Type	2/6
Mark 3 Handmikes	5/6
Mark 7 Dynamic	12/6
Sound Powered	12/6

Post 2/6 Each.

AIRCRAFT GENERATORS

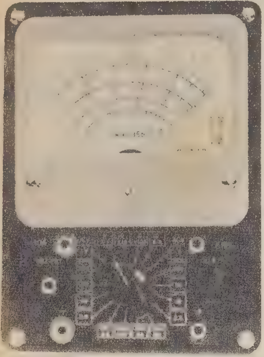
28V. 100AMP. £12/17/6.
28V. 60AMP. £10/10/-.
12V 50 Amp £5-15-0

Beautifully Finished and Highly Sensitive

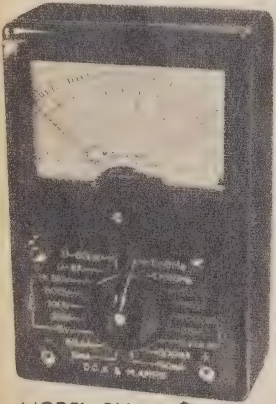
MULTIMETER TESTERS

EXCLUSIVE TO RADIO HOUSE PTY. LTD.

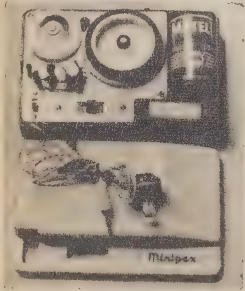
(Handy Size)



MODEL RH-955



MODEL RH-31



TRANSISTOR TAPE RECORDER

Model 201 Minipex,

Dimensions: 5¾in x 3¾in x 1¾in. Fits into a pocket.

Priced £12/10/-.

Complete with earphone and mike combined.

MODEL RH-955

SPECIFICATIONS

1. Sensitivity:
50,000 ohms per volt DC
5,000 ohms per volt AC

2. Ranges:
DC voltage: 0-2.5-10-50-250-1000 volts.
AC voltage: 0-2.5-10-50-250-1000 volts.
DC current: 0-100uA, 0-10-100-500mA, 10 Amps. (all at 250mV)

Resistance:

Ranges	Centre scale
0-20,000 ohms	200 ohms
0-0.2 megs.	2,000 ohms
0-2 megs.	20,000 ohms
0-20 megs.	0.2 megs

Decibels:—20 c/s 46 db 5 ranges (0 db 1mW into 600 ohms)

3. Dimensions: 7in x 5¾in x 3in.

4. Net weight: 2½lb with Batteries.

5. Meter sensitivity: 20uA

Price £23/16/-

MODEL RH-31

- 20,000 Ohms per Volt on DC
- 10,000 Ohms per Volt on AC
- 3½" Meter
- 18 position selector

SPECIFICATIONS

DC Voltages: 0-5-25-100-500-1000-5000 (20,000 Ohms/V)
AC Voltages: 0-5-25-100-500-1000V (10,000 Ohms/Volt)
DC Current: 0-50 uA, 0-5-50-500mA
Resistance: 0-6K-600K, 0-6Meg-60Meg (30 Ohms, 3K, 30K, 440K at centre scale)
Capacitance: 100uuF-0.01uF, 0.002uF-0.3uF
Inductance: 20 H to 2000 H
Decibels: minus 20db to plus 30db in 2 ranges
Output Jack: for Audio measurements
Dimensions: (3⅞" x 5⅜" x 2 3-8")
Weight: (23oz approx.)
Complete with internal battery and testing leads with prods.

PRICE £10/12/6
Including Sales Tax.

SPECIFICATIONS

Fitted with batteries, Standard Torch Cell and 9 Volts Transistor Battery No. 216. Recording time 9 minutes. 60ft full Track Tape. Standard Recording Tape used 200ft for 9/6, enough to fill the supply reel 3 times. Spare reels available. Variable Speed Control. Erases Automatically as it records. Freq. response 300cps to 4000cps. Weight approx. 1lb. Battery life 5 hours. Standard Cell 80 hours Type 950.

MODEL RH-18

- Up-to-date design
- High sensitivity-20,000 Ohm/V DC 10,000 Ohm/V AC
- Rugged construction—clear plastic panel and moulded case
- Wide measuring ranges

SPECIFICATIONS

DC Voltages: 0-6-30-120-600-1200-6000V (20,000 Ohms/V)
AC Voltages: 0-6-30-120-600-1200V (10,000 Ohms/V)
DC Current: 0.60 uA, 0-6-60-600mA, 12A
Resistance: 0-5K-500K, 0-5Meg-50Meg (30 Ohms, 3K, 30K, 300K at centre scale)
Decibels: minus 20db to plus 63db in 5 ranges
Dimensions: (3 5-16" x 6 5-16" x 2⅜")
Weight: (29oz approx.)
Batteries: Penlight 1.5V x1 and 15Vx1, testing leads with prods.

PRICE £13/15/-
Including Sales Tax.

MODEL RH-200

20,000 Ohms per Volt DC
10,000 Ohms per Volt AC

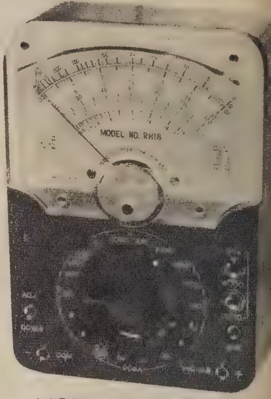
SPECIFICATIONS

DC Volt: 0-5, 0-25, 0-50, 0-250, 0-500, 0-2,500
AC Volt: 0-10, 0-50, 0-100, 0-500, 0-1,000
DC Current: 0-50, Microamperes.
0-25, 0-250 Milliamperes
Resistance: 0-60K Ohms, 0-6Meg Ohms
Capacity: 0.01-0.3mfd (at AC 5 Volt)
0.0001-0.01mfd (at AC 250 Volt)
Decibel: minus 20db plus 22db
Output Range: 0-10, 0-50, 0-100, 0-500, 0-1,000
Battery used: UM-3-1.5V, 1 piece
Dimensions: 3½" x 4½" x 1 1-8"
Complete with internal battery, testing leads and prods.

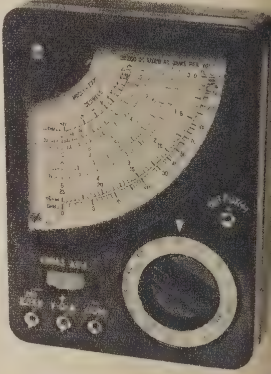
PRICE £7/10/-
Including Sales Tax.

SHAVER

This electric type shaver operates from two 935 standard torch batteries fitted inside the shaver. No wires or outside power; just switch ON and shave. Head easily removed for cleaning.



MODEL RH18



MODEL RH-200

Complete with batteries, £2/19/6

Spare batteries, 2/10.

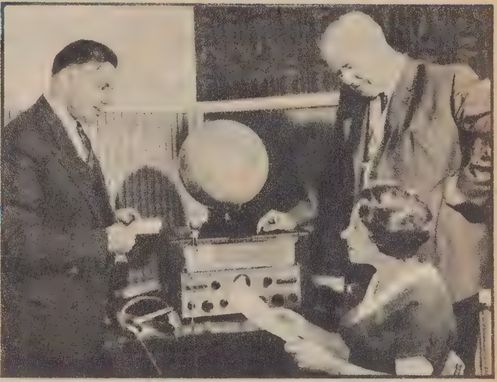
RADIO HOUSE PTY. LTD.

296 PITT STREET, SYDNEY.
Also at 760 George St., and 6 Royal Arcade.

ON SHORTWAVE — By ART CUSHEN

T.U. PLAN WORKS WELL

In its first year of operation, the shortwave listener must feel satisfaction at the general success of the International Telecommunication Union plan to share shortwave frequencies.



Grouped around a short-wave receiver in one of the studios at Bush House, in the Strand, London, headquarters of the BBC External Services, are Bill Hayes (left), producer of "Short Wave Listeners' Corner," broadcast weekly in the BBC General Overseas Service; Dorothy Logan, a well-known announcer who is the compere of the program; and E. A. Beaumont, assistant to the superintendent engineer, BBC External Broadcasting.

NCE its introduction just a year ago, most shortwave listeners agree that the I.T.U. plan done much to give better reception and less rference from other stations.

efore the Frequency Management Plan came operation last year, there was very little rchange of information on the subject of uencies between broadcasting organisations. schedules and frequencies were changed with broadcaster's convenience and this at times ulted in considerable interference.

he new procedure helps to keep all broadting organisations informed of the intention others and four schedule changes are introed each year. These are on the first Sunday March, May, September and November, the mer and winter schedules being in operation four months and the spring and autumn only months.

ach organisation sends its proposed broadcast- schedule to the International Frequency Regislon Board in Geneva, some months before y become effective. For each transmission, the rmation includes the frequency, time of use, a to which the transmission is intended, power the transmitter and the type of aerial to used.

he board then prints all these schedules in master schedule, which is more or less a ster schedule of all shortwave operations. Each mber country receives a copy several weeks ore it becomes operative and this shows what rference can be expected on each frequency. ore the schedule comes into effect, many nor changes are made to cut down interference there is as much co-operation as possible h other countries.

he I.F.R.B. in Geneva also give their help h suggestions in changes of frequencies and es in order to reduce the interference on transmissions which seem to be worst affected.

hough this major change occurs four times h year, minor changes can be made from e to time. This is due to the fact that the edule is not complete, as some countries are members of the organisation. This additional rference from stations in countries not mem- s of the International Telecommunications ion makes for some interference which is unidable and a universal acceptance of the plan uld result in complete co-operation and less rference on all transmissions.

fter the period, a complete survey is carried its effect, with a list of those assignments ich have proved to be unsatisfactory being mpiled. This information includes details the stations which have been causing the rference. In this part, the shortwave listener ys no small part, in identifying interfering nals and notifying this to the stations which e priority on the frequency.

SIGNALS FROM RABAT

EW frequencies have been put into service by the Morrocian Broadcasting System at bat in its services, which include English, and ried over transmitters of 50 and 100Kw.

The schedule is:

Arabic 0630-1000, 1200-1500GMT on 6190, 55Kc and from 1800-2100 on 6190, 7155 and 0Kc.

French is carried from 0645-0830, 1230-1400 7225, and 1830-2200 on 7255, 9505 and 735Kc.

Spanish is broadcast 0830-0900, 1400-1500 and 0-2400 on 7255Kc.

English is broadcast 1200-1230 on 7255Kc., 0-1830 on 7255, 9505, 11735 and 15320Kc.

When closing its transmissions at 1830GMT, station asks for reports from listeners to be t to the African Service, Morrocian Broadting System, Rabat, Morocco.

ZL20 ON 6020KC

NEW frequency for Radio New Zealand used in the session for the New Zealanders the Antarctic is providing very good reception. alling Antartica" is broadcast on Sundays from 15 to 0845GMT. The frequency now in use 6020Kc and the call sign ZL20, which has t been in use for several years, The session cludes a summary of the news and sporting ghlights of the week in New Zealand. This nsmitter is on 11780Kc until 0800, when it oves to 6020Kc.; at 0900 it is back on 11780Kc. d with 6080Kc, carries the transmission from Wellington for listeners in Australia, for the period 0900-1145GMT. The session of tips on Radio New Zealand is broadcast on the first Wednesday of each month, at 0640 and 1030GMT, on 11780 and 6080Kc.

READERS' REPORT

SIGNALS from Latin America are reported by one of our regular readers, David Rayner, of Geelong West, Victoria, who comments that in the last five years this page has provided him with many items that have helped in his listening.

XEOI Mexico City, using 6010Kc., has been heard from fair signals over the last half-hour of its broadcast; Radio Mil signs off at 0605 GMT.

OBX4M Lima "Radio Panamericans," using 5980Kc., has been heard 0530 to 0600.

HJLB on 6040Kc., La Voz de Telima, Colombia, has been noted on Friday to 0645 and on Saturday sign off is 0715GMT.

XEHH in Mexico City uses 11880Kc. and is heard up to 0515GMT, when the frequency is covered by interference from nearby transmitters; the station sign-off is at 0630GMT.

YVKO CARACAS

THE reception of the new Radion Nacional in Caracas last month resulted in a verification in 16 days and the letter included news of the extension of the programs. The new program in English began in June, 1961, and a QSL which is being redesigned and will be sent later. Much information on Venzuela is incorporated in the session, which is released on Monday from 0230 to 0345GMT. A bulletin on the local radio and television programs in Caracas was also promised and is is hoped that the planned extensions will include a session more suited for reception in this area. The station has the address of Radio Nacional, P.O. Box 3979, Caracas, and uses 6170Kc, with 10Kw.

NEW TOKYO STATIONS

THE only commercial station in Japan, which operates on shortwave, the Nippon Shortwave Broadcasting Company, in Tokyo, this past month introduced a new station JOZ4, using 3945Kc. They have also increased power from 10Kw to 50Kw, the three existing stations, JOZ on 3925Kc., JOZ2 on 6055Kc, and JOZ3, which operates on 9595Kc. All these transmissions are heard well in our evenings with Japanese programs and commercial announcements. They verify reports on reception with some of the most attractive cards being issued by stations at the moment.

BRAZILIAN SIGNALS

LOW frequency Brazilians have been heard over the past few weeks with exceptional strength in the 2400 and 3300Kc bands. Reception at times is spoiled by heavy static on this low frequency for short-wave signals, but a summary of signals, which has been heard by Dick Pollard of Gloden Downs, N.Z., and ourselves should be of assistance in tuning these station, all of which carry programs in Portuguese.

2390 Radio Per Um Munco Melhor, Governador Valdares, Brazil, heard from 0900 G.M.T.
2420 ZYW32, Anapolis, Brazil, has been heard at 0915.
2450 ZYR231, Aracatuba, opens at 1000, with fair signal.
3255 ZYR62, Marilia, has been heard at 0930.
3375 ZYK78, Recife, opens its transmission at 0830 with "Old Folks at Home" and cuckoo clock.
4855 ZYR61, Taubata, has been logged at 1000 through some interference.
5965 ZYU60, Porto Alegre, Brazil, has fair signal after 0900, when the Voice of America leaves the frequency.
6045 ZYS33, Curitiba, Brazil, opens at 0800.
6065 Radio Rural Brazileira, has fair signal, when opening at 2200, with call sign ZYZ31, and says, "Hullo, Radio Rural, Brazileira."

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Australian readers may obtain full details from the following Branch Secretaries. Tas.: 2/7194. **Sgt. F. R. Frost, Brighton Camp, Tas.—Vic.: Barrie Boyce, 146 Abbott St., Sandringham.—Sth. Perth: Bob Price, 108 Lansdowne Rd., Sth. Perth.**

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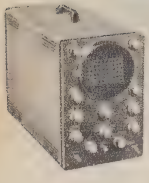

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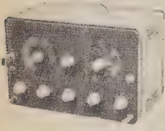

HEATHKIT TV ALIGNMENT GENERATOR KIT—(TS-4A)

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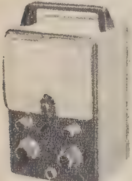

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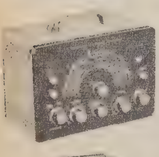

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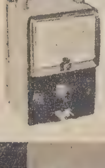

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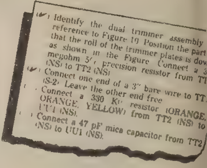
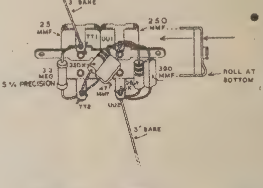


(✓) Identify the dual trimmer assembly
reference to Figure 10 Position the part
that the roll of the trimmer plates is dow
as shown in the Figure Connect a 3
megohm 5%, precision resistor from T
(NS) to TT2 (NS)
(✓) Connect one end of a 3" bare wire to TT
(S-2) Leave the other end free
( ) Connect a 330 K Ω resistor (ORANGE,
ORANGE, YELLOW) from TT2 (NS) to
UU1 (NS).
( ) Connect a 47 pF mica capacitor from TT2
(NS) to UU1 (NS).



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WF 96/FP

FLASHES FROM EVERYWHERE

ENEZUELAN signals are being widely re-
ed in their morning programs and these in-
e YVKX on 3310Kc, opening at 1030 G.M.T.
orts Dick Pollard of Nelson, N.Z.). Others
this country include "Radio Tropical"
P on 4860Kc, YVKF on 4880Kc, and YVKB
4890Kc, all these signals being heard around
G.M.T. YVKB in fact opened at 1030
.T.

HILIPPINE station DZUP, located at the Uni-
ity of the Philippines, has now been heard
7165Kc with sign-off at 1300 G.M.T. The
on, which now uses 1,000 watts, relays the
dcast band transmitter of the same call,
ted in the University of the Philippines build-
The short-wave frequency was formerly on
then 7160 and now 7165Kc is its latest
ating channel.

HANA has been testing on 17875Kc accord-
to a Californian listener and the station is
he air from 1200 to 1900 G.M.T. English
is carried at 1800, but there is considerable
ference on this frequency at that hour.

URMA is carrying out a test from Rangoon
17870Kc from 1545 to 1645 G.M.T. The
on has announcements at 1600 G.M.T., when
give the identification in English and French,
many listeners will be aware that the Rangoon
ons are not one of the best at verifying
rts from short-wave listeners.

ATANGA broadcasting from Elizabethville has
ed to 11880Kc and has some interference
XEHH in Mexico City. The station has
rench news bulletin at 0500 and at 0530 has
heard in a local language transmission. The
on comes on the air at 0430 G.M.T.

ONROVIAN station ELWA, located in the
tal of Liberia, has moved from 11825 to
5Kc, and is being heard from 0530 to 0730
.T. This channel is also used to North
rica on Wednesday to 0330 G.M.T.

ASHINGTON, the site of the Voice of
rica, is now sending out a three-hour trans-
ion for listeners in Brazil in the Portuguese
uage. This new service is broadcast from
to 0100 G.M.T. and on 17755, 15330 and
11830Kc.

ATICAN signals have been noted at two dif-
nt times at good strength during the recent
ks. The transmission to Brazil in Portuguese
eard on 17860Kc from 2300 G.M.T. A further
ice to listeners in Czechoslovakia is heard on
Kc; this broadcast takes place at 1930 G.M.T.

AKAR in Senegal has been heard in Europe
news in French at 0710 and 1800 G.M.T.
the new channel of 11950Kc. The reports
listeners indicate severe interference on the
uency.

**Notes from readers should be sent to
rthur Cushen, 212 Earn Street, Inver-
argill, N.Z. Times are Greenwich Mean
Time, 8 hours behind Western Australian
ime, 10 hours behind Eastern Australian
nd 12 hours behind New Zealand Standard
ime.**

AVANA continues with its experimental trans-
ions, which we hear best in this area at
G.M.T. on 11875Kc, with English. Euro-
listeners report the test on 21625Kc, between
-1900, made up of broadcasts in Portuguese
-1740 French 1740-1820, English from 1820
ign-off at 1900 G.M.T.

RUGUAY will be heard on short wave via
ew station next year, following the purchase
CX42 in Montevideo, Uruguay, by the opera-
of HCJB in Quito, Ecuador. This station
2,500 watts on 1370Kc operates on broad-
band only, but short-wave transmitters are
cted to be added, when the station will com-
ce its gospel broadcasts for the listeners in
guay and Argentina.

ADRID'S Radio Nacional Espania has ses-
s in English from 2020 to 2050 G.M.T. for
ners in Europe. The frequency used is 6130
9365Kc. The service to North America is
-0400, 0415-0500 and 0515-0600. These broad-
s are released on the same frequencies
igh, over the past few weeks, the first trans-
sion now is broadcat on 6175Kc, which
aces 6130Kc.

UWAIT has proved a good signal for morn-
listening in this area and the station, which
4967Kc, now closes at 2100 G.M.T. Reports
Europe state that sign-off includes a clock
ing 12, and then a short announcement in
bic.

ADIO SOUTH AFRICA is now the new
an of the S.A.B.C. short-wave transmissions
e it became a Republic. The Africa service
till broadcast and is on the air, 1100-1800 on
5Kc, 0600-0800 on 17855Kc, 1100-1600 on
4Kc, and 1500-2000 G.M.T on 15300Kc. On
sday, Thursday and Saturday the programs
in English and on other days in Afrikaans.

WISS transmissions to Africa have been heard
an additional frequency, when the station
ies its regular broadcasts in French, German
Italian. The new frequency is 15305Kc. This
nel is used 0545-0645 on weekdays, 0615-0700
Sundays, 1730 to 2145 G.M.T. daily.

AIRO in the United Arab Republic uses
0Kc with a session in English to Africa. The
smission is noted from 2130 to 2215 G.M.T.
after this concludes, a program in French
roadcast. The signals in this area are good
at times the transmission, which is on news
commentaries, has been heard as late as 2220
I.T. before the French transmission takes over.

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50in x 24in

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ANSWERS TO CORRESPONDENTS

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' Sir,

wish to thank you for the article olar Hot Water Heaters at the end st year.

made up a single unit 8 feet x 3 and, as my 60-gallon off-peak tank a floor model, I had to mount my only one foot above ground.

put the inlet into the tank about hird down from the top of the tank this allows about 20 gallons of the d water to lie above the circula- circuit.

nfortunately, during the winter hs when the sun is low in the sky, nit is shaded by trees in my neighbour's gardens and it only gets the full sunlight between 10 a.m. and 2 p.m.

For the first 3 months my electricity consumption was down by two-thirds and for the last three months by at least half, which means it will pay for itself in less than four years.

I turned a small shoulder on the ½in copper pipes and bored 7/16in holes in the larger pipes; this simplified the construction as I had a solid stop to cramp the one-inch pipes against. I hope to see more such constructive articles in the future.

Yours faithfully,
R. W. (Leichhardt, N.S.W.)

.S. (Kiki Kiki, N.Z.), asks if fre- cy division would be practical in a mitter, for instance to allow trans- on on 3.5 Mc/s when the VFO is o 7.0 Mc/s.

: Frequency division is a practical M.S., but it has a number of dis- ntages. Firstly, it is usually not pos- to extract any sub-harmonic from ine wave output of a VFO, so the ion must take the form of "trigger- of a second oscillator operating he sub-harmonic frequency. Ob- ly, this offers very little saving in or components over a single oscil- —the chief advantage being that wo oscillators are locked.

condly, the locking tends to be r erratic on sine-wave signals, as are no sharp wave-fronts to pro- precise triggering. Thus the original l should really be distorted in some which introduces further compli- ns.

★ ★ ★

A.H. (Melbourne, Vic.), asks if we d explain how the complete elec- l process of playing a gramophone d works, in the "Here's Your ver, Tom" section of the magazine.

.: As you are no doubt aware, H., we are at present discussing test uments in that section of the maga- However, we will certainly file query away for use when the cur- series ends.

★ ★ ★

N. (East Malvern, Vic.), sends in a le one-diode and transistor circuit possible use in our "Reader Built age.

: We doubt whether we can make ediate use of your contribution, if because we have published a num- of simple circuits in the last few hs. However, the circuit has been for possible future use.

★ ★ ★

S. (Perenjori, W.A.): Writes that o has experienced the "tinkling" ds in valves as they warm up (Ref. .S., August, 1960), and also in a . 138A tube. He mentions a strange t with his CRO, whereby the deflection sensitivity of the tube when isolated from the amplifiers is altered by connecting the amplifiers to the HT line. regarding the use of barretters in transformerless equipment, he asks why inductors are not used, since they do not dissipate power.

A.: We are a bit puzzled by the story of your CRO, T.S., particularly as you maintain that the deflection plates are not connected to the rest of the circuit. The only idea we can offer is that the last anode is connected to the HT line in question, and that the HT voltage is very poorly regulated. The resulting change in voltage distribution, with the extra load applied, would alter deflection sensitivity.

One reason that inductors are not used on transformerless sets is that many are intended for AC or DC operation. As you are no doubt aware, the inductor would have no effect on direct current. Thus a resistance (either normal or temperature sensitive type) is used. For sets which are not intended for "universal" or AC/DC operation, however, the idea is basically a good one—at least in a modified form. Some commercial sets have used a capacitor to drop the voltage to the required value, utilising the capacitive rather than inductive reactance This has two things to recommend it; one is that it is appreciably cheaper, the other that the set is protected if accidentally connected to DC. This would not be the case with the inductor, alas! The barretter has one particular advantage in that it regulates the voltage applied to the receiver, thereby absorbing line variations.

★ ★ ★

J. A. H. (Chester Hill, N.S.W.) would like to see us describe the construction of a small electronic organ.

A.: This is something which we have had in mind for some time and it so happens that one of our staff members is experimenting privately with organ circuits, etc., with a view to building an instrument. Should anything come of this work, it will probably make its appearance in the magazine in due course.

RADIO, TELEVISION AND HOBBIES QUERY SERVICE

TO assist our readers, "Radio, Television and Hobbies" conducts a technical query service. Conditions governing this service are set out below:—

(1) Requests for copies of circuits or technical queries requiring an answer through the post must be accompanied by postal note or stamps to the value of TWO SHILLINGS. Queries not accompanied by a fee will be answered in rotation on these pages.

(2) For the 2/ fee, we will supply circuit data, as available, for up to three projects. The amount of data available varies , but in no case can it include information additional to that already published in the magazine. As a rule, requests for circuits will be answered more speedily if they are clearly identified and not complicated by questions requiring the attention of technical personnel.

(3) The technical query service is aimed primarily at assisting readers in matters relating directly to articles published in the magazine. Answers will be given in note form and only so far as can be drawn from general knowledge of the relevant subject. We cannot provide lengthy answers, undertake special research, discuss commercial designs or draw special circuits.

(4) The Editor reserves the right to return query fees or to limit the scope of an individual reply, where it is felt that a partial answer will be better than none at all. Please note that the inclusion of an extra fee does NOT entitle correspondents to special consideration.

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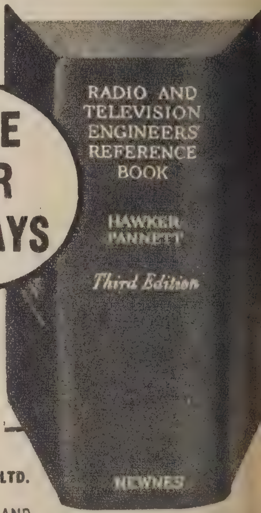

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IDEAS GET MODERN TREATMENT

(Continued from Page 5)

this direction and now one American m is currently establishing a dealer ganisation for its flying car, which sts the equivalent of £5,000.

From all reports, the Aerocar is a ll-scale flying machine. It cruises at ,000 feet with a speed of 90 m.p.h.

The unique point about the Aerocar that it can be converted from a car a plane in only five minutes. This done by having a series of interlock- components which snap-fit into each ıer. A system of electrical contacts control a series of lights which glow if the plane should be incorrectly assembled.

To make double sure, the engine will not start unless all the pressure-sensitive switches are closed.

The Aerocar consists of two separate packages. One is the car proper which, although stunted in length, is a fully fledged automobile, capable of normal highway speeds. The other is a trailer which can be towed behind the car on those occasions when it is to take the air. The trailer is really the second half of the fuselage. It has retractable wings and tail.

The cockpit is understandably small, housing only two people and a minimum of luggage. A four cylinder Lycoming engine is used as the power plant for both road and air use. Front-wheel drive is employed for obvious reasons.

In America, where some businessmen use a plane the same way as some people use cabs, the Aerocar holds great promise. Because the vehicle can be converted to a complete flying machine (and back again) in five minutes, it becomes practical to drive to an airfield, take off and later use the car again at the arrival point.

For businessmen this not only saves time but saves the added expense of hiring a vehicle at the other end.

COMPLETING THE R. TV & H. SET

(Continued from Page 53)

run extension leads to the tube in e cabinet.

A strip of ¼in thick foam rubber is ıced underneath the strap running ound the face plate of the tube so at the strap does not tighten on to the ass direct. At each corner of this ap, a small hook-shaped bracket is tached by means of two bifurcated ets and used to grip the aforemen- ned projection on the corners of the e plate.

A "U" bracket is screwed to the ntre of the lower edge of the strap d, when fastened to the chassis, takes st of the weight and adds rigidity to whole assembly.

Tubes having a "bonded" face plate ll not normally require the use of a ety glass although, if a mask is used, may be better, in the interests of "fin-" to include a glass in front of the ısk.

So much then for the adjustments. ace does not permit a detailed treat- nt of the remote control unit this nth, which in many respects is simi- to the one described in the January, 60, issue. However, in a subsequent ue we hope it will be possible to in- de the details necessary to provide note channel change facilities which are investigating at the present time.

Practical Aspects of The Tunnel Diode

(Continued from Page 69)

rated as an amplifier at high gains l prone to distortion.

As we saw earlier, it is also ineffi- nt to use with dry cells, etc., because the requirements of very low power ply resistance and low operating tage. For widespread use in many lications in which it has a potential , either it or the circuits involved l have to undergo a certain amount modification. If this occurs, revolu- ıary things will surely happen. In rt, we had better watch tunnel diode gress carefully.

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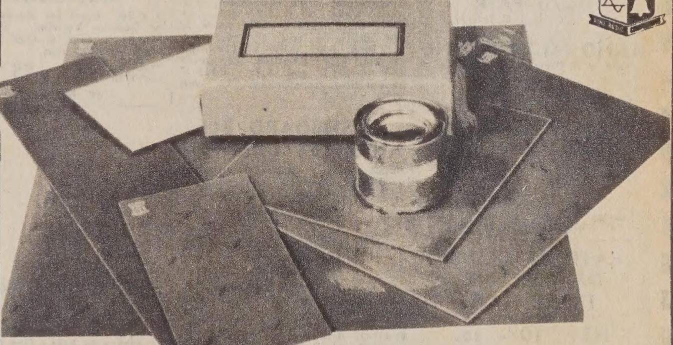
JABEL



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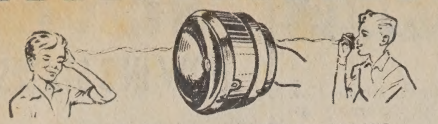

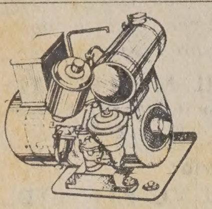

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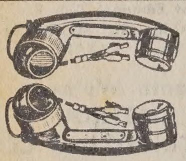

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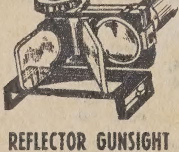

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Decibel, minus 16 to plus 3	37/6
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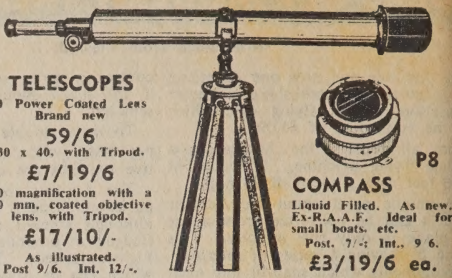

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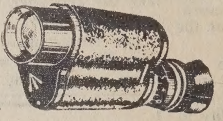

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IVING ISN'T EASY

(Continued from Page 14)

Thus, all parts of the body must bject to the same pressure.

ere is a well-known law which says, ect, that if a gas is in contact with id which does not chemically react t, the gas is absorbed by the liquid. mount of gas absorbed is greater igher the pressure to which it is ted.

w in the air there are three main namely, oxygen, nitrogen and n dioxide. These three gases then nder pressure in any diving appa- and threfore in contact with the s blood through the lung tissues. ree are absorbed by the blood.

oxygen, as a matter of course, is up in the body tissues while the n dioxide does not increase to any in the blood, because it is passed hrough the process of breathing. ver, the nitrogen remains absorbed blood.

w we all know what happens when ap is taken off a bottle of soda The carbon dioxide, being ab- l by the water under pressure, es out immediately the pressure is ed.

imilar thing happens to a diver's if the air pressure is reduced too nly. Bubbles of nitrogen form in oodstream. If the case is serious, ght side of the heart becomes filled gas and death is almost instanta- Or gas may accumulate in the cord, resulting in paralysis of the Less serious effects are manifested ains in the joints or muscles, a y commonly called "the bends."

diver's ascent then must be care- controlled so that he rises gradually surface.

r the years experience has shown diver can come up from, say, 198 o 82 feet fairly quickly. From his ascent must be carefully con- l according to a set of tables, with pauses so that nitrogen bubbles do rm. If, by mischance, the diver is ed by "compressed air illness" on ng the surface, he must either be own again or placed in a chamber surface under pressure so that he e "decompressed" correctly. The may take days to accomplish, once es have formed in the bloodstream.

effects of carbon dioxide on the under pressure is more serious the r the pressure. At a depth of 33 per cent of carbon dioxide will the same effect as 2 per cent at rface.

a depth of 99 feet only ½ per cent rbon dioxide will have the same as 2 per cent at the surface. l apparatus is provided to absorb as so that the percentage present lways be at a safe level.

s important that a diver does not d when he has a cold in the head se his eustachian tubes, leading his ears to his throat, may be d. These tubes balance the air re on either side of the eardrum. tubes were blocked the pressure not be equalised and there would langer of burst eardrums.

ting a diver down—and up again not a simple matter but a highly fic undertaking.

THE R., TV & H. CROSSWORD No. 86

1		2		3			4		5	■	■	6
	■		■		■	■		■	7	8	9	
10					11	■		■	12			
	■		■	13							■	
14			15			■	■	■		■	■	
	■	■	16			17		■	■	18		
19	20	21		■	■		■	22	■		■	■
23					■	24	25					
26				■	27				■		■	■
	■	28		29					30		31	32
	■		■	33		■	■	■	34			
35								■	36			
■	■		■	■		■	■	37				

ACROSS

1. A measure of selectivity.
7. Character of a sound.
10. All put together.
12. Frozen droplets.
13. Fine adjustment.
14. New Englander in the U.S.A.
16. Complex aerial system.
18. Container
19. Average.
23. Prize.
24 Galvanic cell.
26. Timber
27. Layer.
28. Streams of electrons
33. Diphthong.
34. Preposition.
35. By which movement a TV picture is formed.
36. Country.
37. Town in Europe.

DOWN

1. AC motors in synchronism.
2. Unit of light.
3. Dextrous.
4. Gas
5. It's not actually there!
6. Electrical scientist.
8. One of a pair.
9. Part of N.Z. (abbr.)
11. Animal
15. Pacific native.
17. Not video.
18. Officials.
20. Direction.
21. Shrubs.
22. Australian lake.
25. Colour.
27. Pronoun.
29. Punish.
30. Knocks.
31. Olden time.
32. Drawn out.

Last month's solution

A	M	P	L	I	T	U	D	E	■	N	■	E
M	■	H	I	S	■	■	I	■	S	E	E	R
A	D	A	P	T	O	R	S	■	P	U	R	E
L	■	S	■	H	■	A	S	T	A	T	I	C
G	L	E	A	M	■	T	O	R	■	R	E	T
A	■	S	L	U	G	■	N	O	R	A	■	■
M	O	P	E	S	■	■	A	D	U	L	T	S
■	■	L	■	■	N	A	N	■	N	■	■	L
G	R	I	D	C	I	R	C	U	I	T	■	U
R	I	T	A	■	C	L	E	N	C	H	E	D
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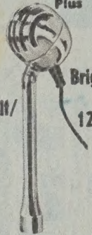

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